SURGICAL ANATOMY

THE PLATES

OF

MACLISE'S SURGICAL ANATOMY,

WITH THE DESCRIPTIONS.

FROM THE ENGLISH EDITION.

WITH

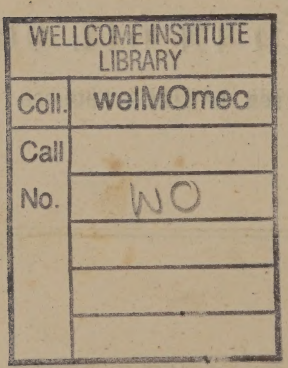
AN ADDITIONAL PLATE FROM BOUGERY.

EDITED BY R. U. PIPER, M. D.

PRINTED IN OIL COLORS,

AFTER BAXTER'S PROCESS.

BOSTON:
PUBLISHED BY JOHN P. JEWETT AND COMPANY.
CLEVELAND, OHIO:
HENRY P. B. JEWETT.
M.DCCC.LVII.



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PHŒNIX BUILDING, BOSTON, MASS.

EDITOR'S PREFACE.

In this edition of the plates, etc., of Maclise's Surgical Anatomy, the figures are arranged as in the original English edition; so that the successive steps of each dissection are shown on the same page. The particular description of the parts marked by references, is placed on the pages facing the plates, thus obviating the inconvenience of turning the leaf to consult it. In order to reduce the bulk of the work, and the cost, so that it might come within the means of every one interested in the subject, it was thought by eminent professional gentlemen, who were consulted, it would be best to give the plates with the mere description, as in the present form.

The plates have been printed in oil colors, at the establishment of Mr. Charles H. Crosby, and the work done mainly by Mr. John O'Neil. This is the first attempt, we believe, to give a series of scientific plates executed in this manner; and they have therefore, during the progress of the work, been submitted to many of our most prominent scientific men, among whom may be mentioned Profs. Haywood, H. G. Bigelow, Agassiz, etc., etc., and have met with warm approval.

The subscriber would take the liberty to ask his scientific brethren to encourage the efforts of the publishers to give us scientific works, the plates of which are so clear and beautiful, and which may eventually do much for the cause of science.

R. U. PIPER.

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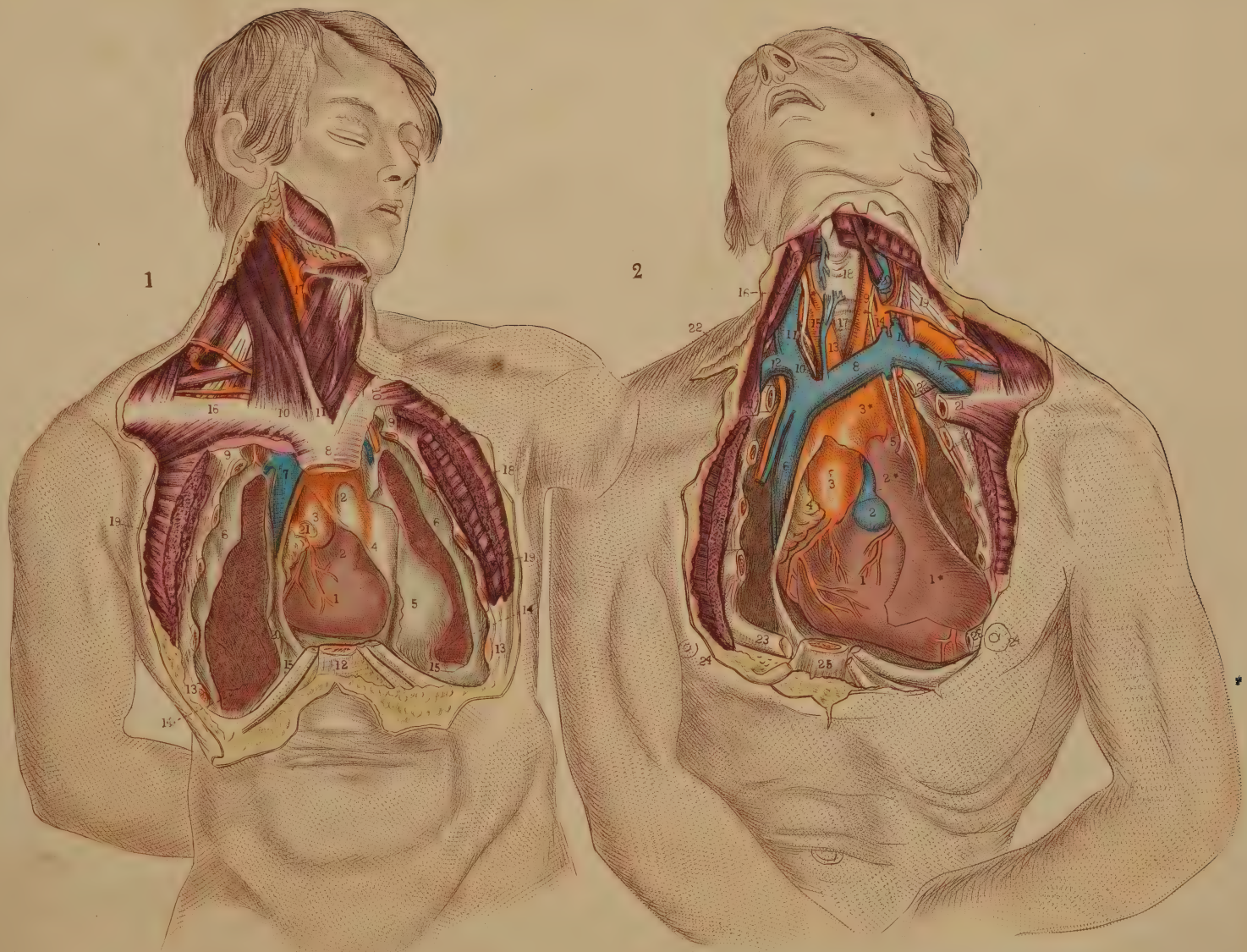
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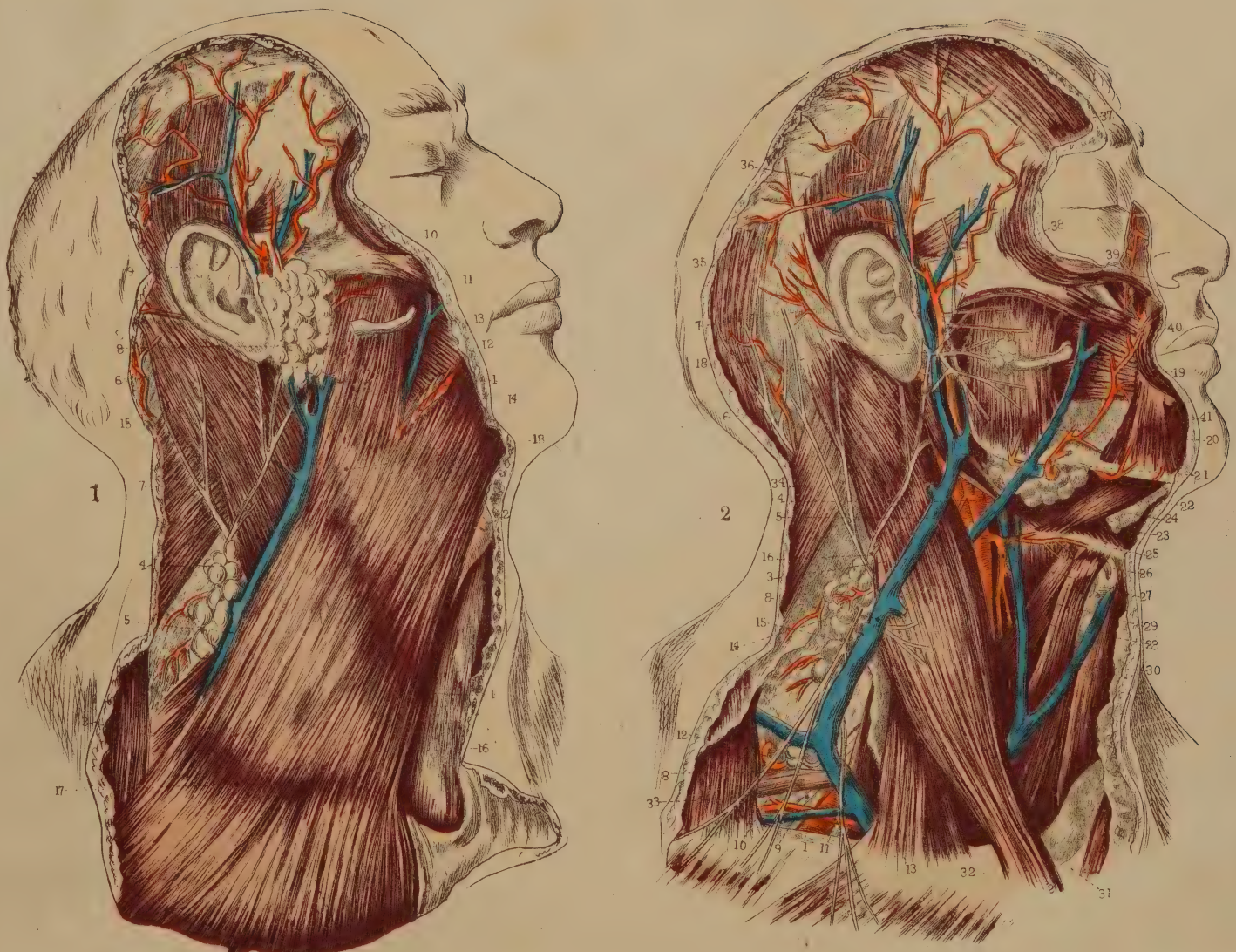
DESCRIPTION OF PLATE 1.

Figure 1.

1. Right ventricle of the heart.
2. Origin of pulmonary artery.
3. Commencement of the systemic aorta, ascending part of aortic arch.
4. Pericardium investing the heart and the origins of the great blood-vessels.
5. Mediastinal pleura, forming a second investment for the heart, blood-vessels, etc.
6. Costal pleura, seen to be continuous above with that which forms the mediastinum.
7. Vena cava superior, entering pericardium to join 21, the right auricle.
8. Upper third of sternum.
9. First ribs.
10. Sternal ends of the clavicles.
11. Upper end of sternum.
12. Lower end of sternum.
13. Fifth ribs.
14. Collapsed lungs.
15. Arching diaphragm.
16. Subclavian artery.
17. Common carotid artery, at its division into internal and external carotids.
18. Great pectoral muscles.
19. Lesser pectoral muscles.
20. Mediastinal pleura of right side.
21. Right auricle of the heart.

Figure 2.

1. Right ventricle of the heart. 1*. Pericardium.
2. Pulmonary artery. 2*. Pericardium.
3. Ascending aorta. 3*. Transverse aorta.
4. Right auricle.
5. Ductus arteriosus in the loop of left vagus nerve, and close to phrenic nerve of left side.
6. Superior vena cava.
7. Left subclavian vein.
8. Brachio-cephalic vein of left side.
9. Left common carotid artery.
10. Lower end of left internal jugular vein.
11. Right internal jugular vein.
12. Right subclavian vein.
13. Innominate artery — brachio-cephalic.
14. Left subclavian artery crossed by left vagus nerve.
15. Right subclavian artery crossed by right vagus nerve, whose inferior laryngeal branch loops under the vessel.
16. Right common carotid artery.
17. Trachea.
18. Thyroid body.
19. Brachial plexus of nerves.
20. Upper end of left internal jugular vein.
21. Clavicles cut across and displaced downwards.
22. The first ribs.
23. Fifth ribs cut across.
24. Right and left mammæ.
25. Lower end of sternum.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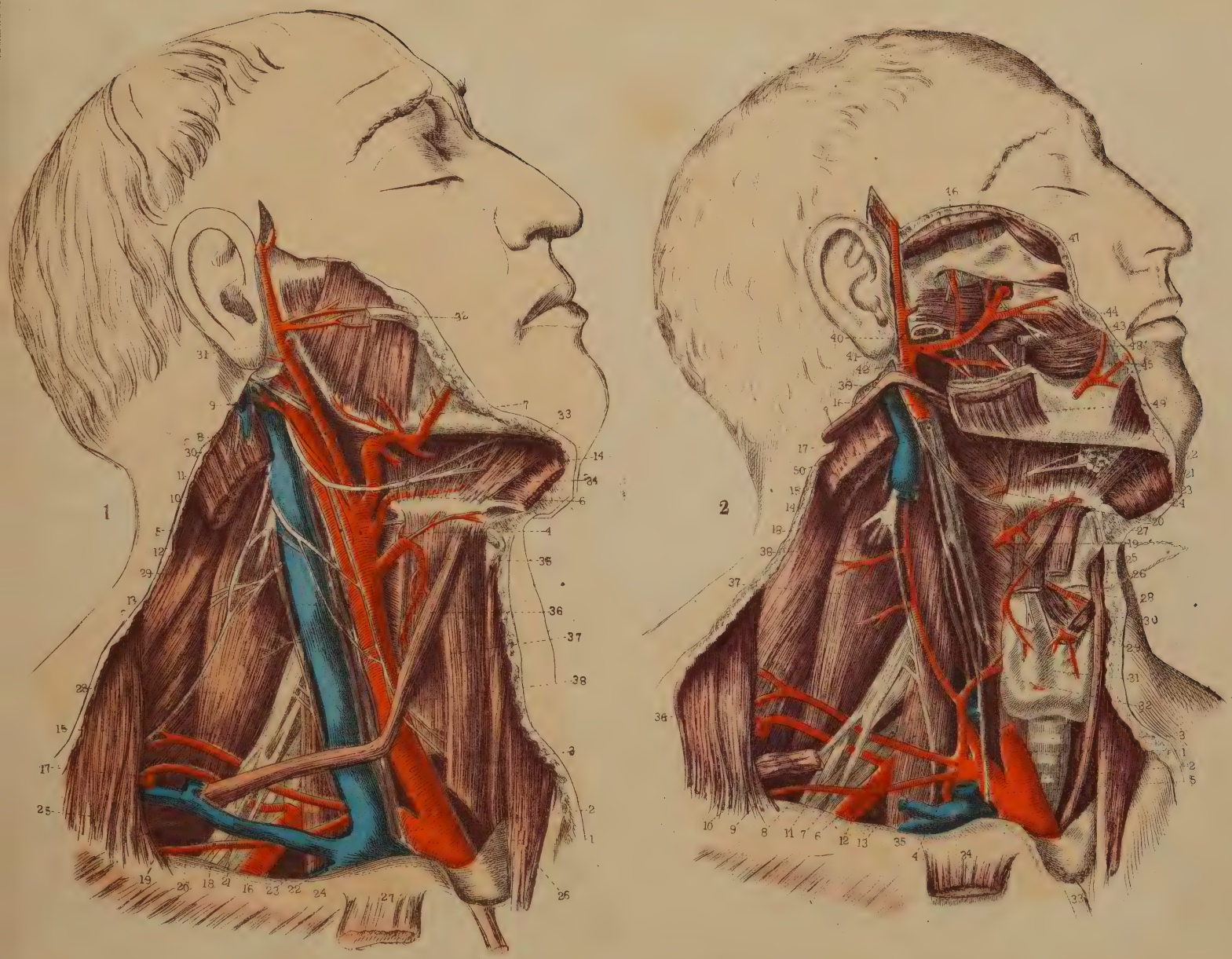
DESCRIPTION OF PLATE 2.

Figure 1.

1, 1. Subcutaneous platysma myoides muscle, lying on the face, neck, and upper part of the chest, and covering the structures contained in the two surgical triangles of the neck.
2. Lip of the thyroid cartilage.
3. Clavicular attachment of the trapezius muscle.
4. Some lymphatic bodies of the post triangle.
5. External jugular vein.
6. Occipital artery, close to which are seen some branches of the occipitalis minor nerve of the cervical plexus.
7. Auricularis magnus nerve of the superficial cervical plexus.
8. Parotid gland.
9. Temporal artery, with its accompanying vein.
10. Zygoma.
11. Masseter muscle, crossed by the parotid duct, and some fibres of platysma.
12. Facial vein.
13. Buccinator muscle.
14. Facial artery seen through fibres of platysma.
15. Mastoid half of sterno-mastoid muscle.
16. Locality beneath which the commencements of the subclavian and carotid arteries lie.
17. Locality of the subclavian artery in the third part of its course.
18. Locality of the common carotid artery at its division into internal and external carotids.

Figure 2.

1. Subclavian artery passing beneath the clavicle, where it is crossed by some blood-vessels and the nerves.
2. Sternal attachment of the sterno-mastoid muscle, marking the situation of the root of common carotid.
3. Common carotid at its point of division, uncovered by sterno-mastoid.
4. External carotid artery branching into lingual, facial, temporal, and occipital arteries.
5. Internal carotid artery.
6. Temporo-maxillary branch of external carotid artery.
7. Temporal artery and temporal vein, with some ascending temporal branches of portio-dura nerve.
8. External jugular vein descending from the angle of the jaw, where it is formed by the union of temporal and maxillary veins.
9. Brachial plexus of nerves in connection with A, the subclavian artery.
10. Posterior half of the omo-hyoid muscle.
11. Transversalis colli artery.
12. Posterior scapular artery.
13. Scalenus anticus muscle.
14. Lymphatic bodies of the posterior triangle of neck.
15. Superficial descending branches of the cervical plexus of nerves.
16. Auricularis magnus nerve ascending to join the portio-dura.
17. Occipital artery, accompanied by its nerve, and also by some branches of the occipitalis minor nerve, a branch of cervical plexus.
18. Portio-dura, or motor division of seventh pair of cerebral nerves.
19. Parotid duct.
20. Facial vein.
21. Facial artery.
22. Submaxillary gland.
23. Digastric muscle.
24. Lymphatic body.
25. Hyoid bone.
26. Thyroid cartilage.
27. Superior thyroid artery.
28. Anterior jugular vein.
29. Hyoid half of omo-hyoid muscle.
30. Sterno-hyoid muscle.
31. Top of the sternum.
32. Clavicle.
33. Trapezius muscle.
34. Splenius capitis and colli muscle.
35. Occipital half of occipito-frontalis muscle.
36. Levator auris muscle.
37. Frontal half of occipito-frontalis muscle.
38. Orbicularis oculi muscle.
39. Zygomaticus major muscle.
40. Buccinator muscle.
41. Depressor anguli oris muscle.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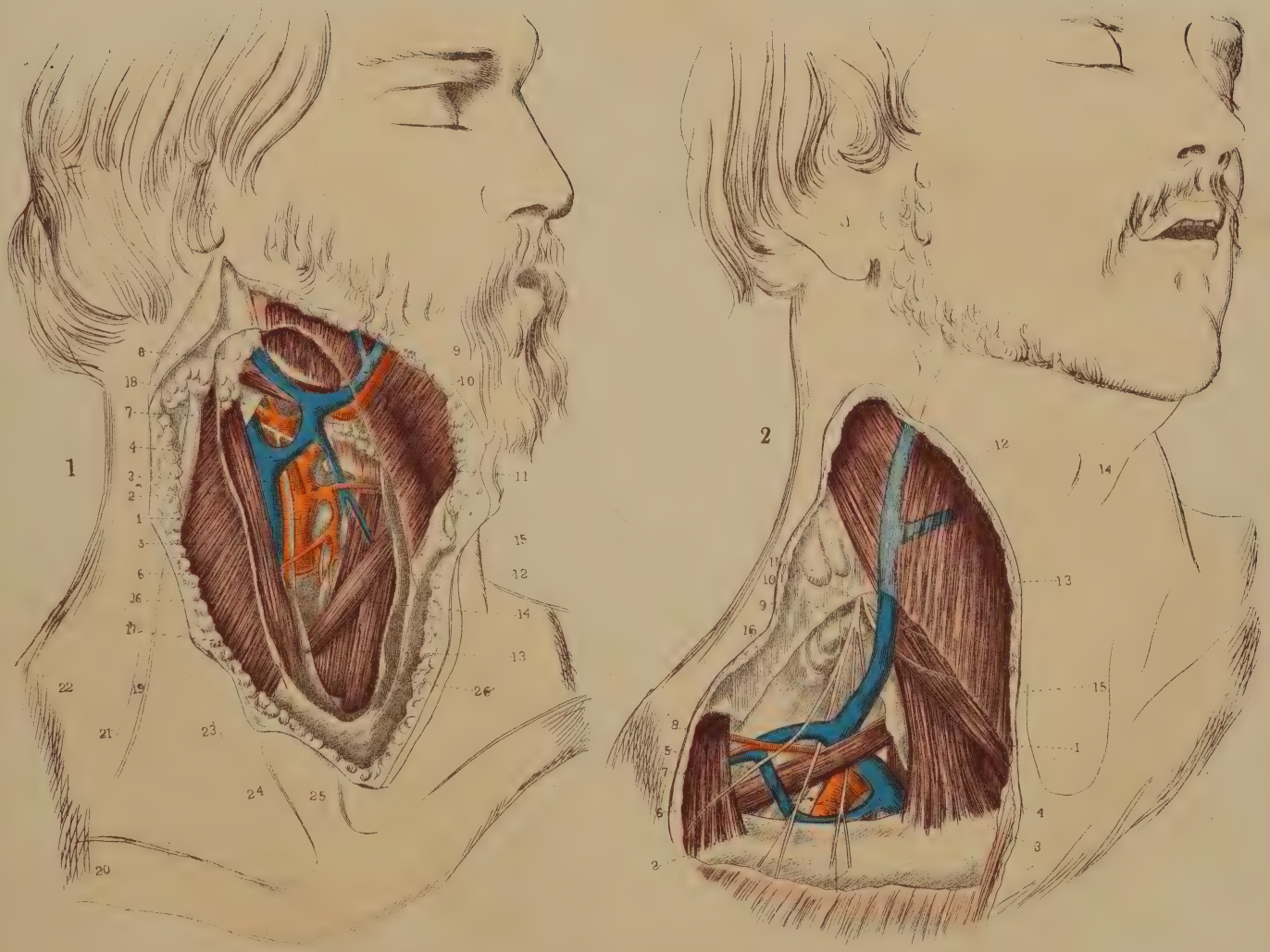
DESCRIPTION OF PLATE 3.

Figure 1.

1. Innominate artery at its point of bifurcation.
2. Subclavian artery crossed by the vagus nerve.
3. Common carotid artery with the vagus nerve at its outer side, and the descendens noni nerve lying on it.
4. External carotid artery.
5. Internal carotid artery with the descendens noni nerve lying on it.
6. Lingual artery passing under the fibres of the hyo-glossus muscle.
7. Tortuous facial artery.
8. Temporo-maxillary artery.
9. Occipital artery crossing the internal carotid artery and jugular vein.
10. Internal jugular vein crossed by some branches of the cervical plexus, which join the descendens noni nerve.
11. Spinal accessory nerve, which pierces the sterno-mastoid muscle, to be distributed to it and the trapezius.
12. Cervical plexus of nerves giving off the phrenic nerve to descend the neck on the outer side of the internal jugular vein and over the scalenus muscle.
13. Vagus nerve between the carotid artery and internal jugular vein.
14. Ninth or hypoglossal nerve distributed to the muscles of the tongue.
15. Branches of the brachial plexus of nerves.
16. Subclavian artery in connection with the brachial plexus of nerves.
17. Post scapular artery passing through the brachial plexus.
18. Transversalis humeri artery.
19. Transversalis colli artery.
20. Union of the post scapular and external jugular veins which enter the subclavian vein by a common trunk.
21. Post-half of the omo-hyoid muscle.
22. Part of the subclavian vein seen above the clavicle.
23. Scalenus muscle separating the subclavian artery from the vein.
24. Clavicle.
25. Trapezius muscle.
26. Sternal origin of sterno-mastoid muscle of left side.
27. Clavicular origin of sterno-mastoid muscle of right side turned down.
28. Scalenus posticus muscle.
29. Splenius muscle.
30. Mastoid insertion of sterno-mastoid muscle.
31. Internal maxillary artery passing behind the neck of lower jaw-bone.
32. Parotid duct.
33. Genio-hyoid muscle.
34. Mylo-hyoid muscle, cut and turned aside.
35. Superior thyroid artery.
36. Anterior half of omo-hyoid muscle.
37. Sterno-hyoid muscle, cut.
38. Sterno-thyroid muscle, cut.

Figure 2.

1. Root of the common carotid artery.
2. Subclavian artery at its origin.
3. Trachea.
4. Thyroid axis of the subclavian artery.
5. Vagus nerve crossing the origin of subclavian artery.
6. Subclavian artery at the third division of its arch.
7. Post scapular branch of the subclavian artery.
8. Transversalis humeri branch of subclavian artery.
9. Transversalis colli branch of subclavian artery.
10. Posterior belly of omo-hyoid muscle, cut.
11. Median nerve branch of brachial plexus.
12. Musculo-spiral branch of same plexus.
13. Anterior scalenus muscle.
14. Cervical plexus giving off the phrenic nerve, which takes tributary branches from brachial plexus of nerves.
15. Upper part of internal jugular vein.
16. Upper part of internal carotid artery.
17. Superior cervical ganglion of sympathetic nerve.
18. Vagus nerve lying external to sympathetic nerve, and giving off t. its laryngeal branch.
19. Superior thyroid artery.
20. Lingual artery separated by hyo-glossus muscle from
21. Lingual or ninth cerebral nerve.
22. Sublingual salivary gland.
23. Genio-hyoid muscle.
24. Mylo-hyoid muscle, cut and turned aside.
25. Thyroid cartilage.
26. Upper part of sterno-hyoid muscle.
27. Upper part of omo-hyoid muscle.
28. Inferior constrictor of pharynx.
29. Cricoid cartilage.
30. Crico-thyroid muscle.
31. Thyroid body.
32. Inferior thyroid artery of thyroid axis.
33. Sternal tendon of sterno-mastoid muscle, turned down.
34. Clavicular portion of sterno-mastoid muscle, turned down.
35. Clavicle.
36. Trapezius muscle.
37. Scalenus posticus muscle.
38. Rectus capitis anticus major muscle.
39. Stylo-hyoid muscle, turned aside.
40. Temporal artery.
41. Internal maxillary artery.
42. Inferior dental branch of fifth pair of cerebral nerves.
43. Gustatory branch of fifth pair of nerves.
44. External pterygoid muscle.
45. Internal pterygoid muscle.
46. Temporal muscle cut to show the deep temporal branches of fifth pair of nerves.
47. Zygomatic arch.
48. Buccinator muscle, with buccal nerve and parotid duct.
49. Masseter muscle cut on the lower maxilla.
50. Middle constrictor of pharynx.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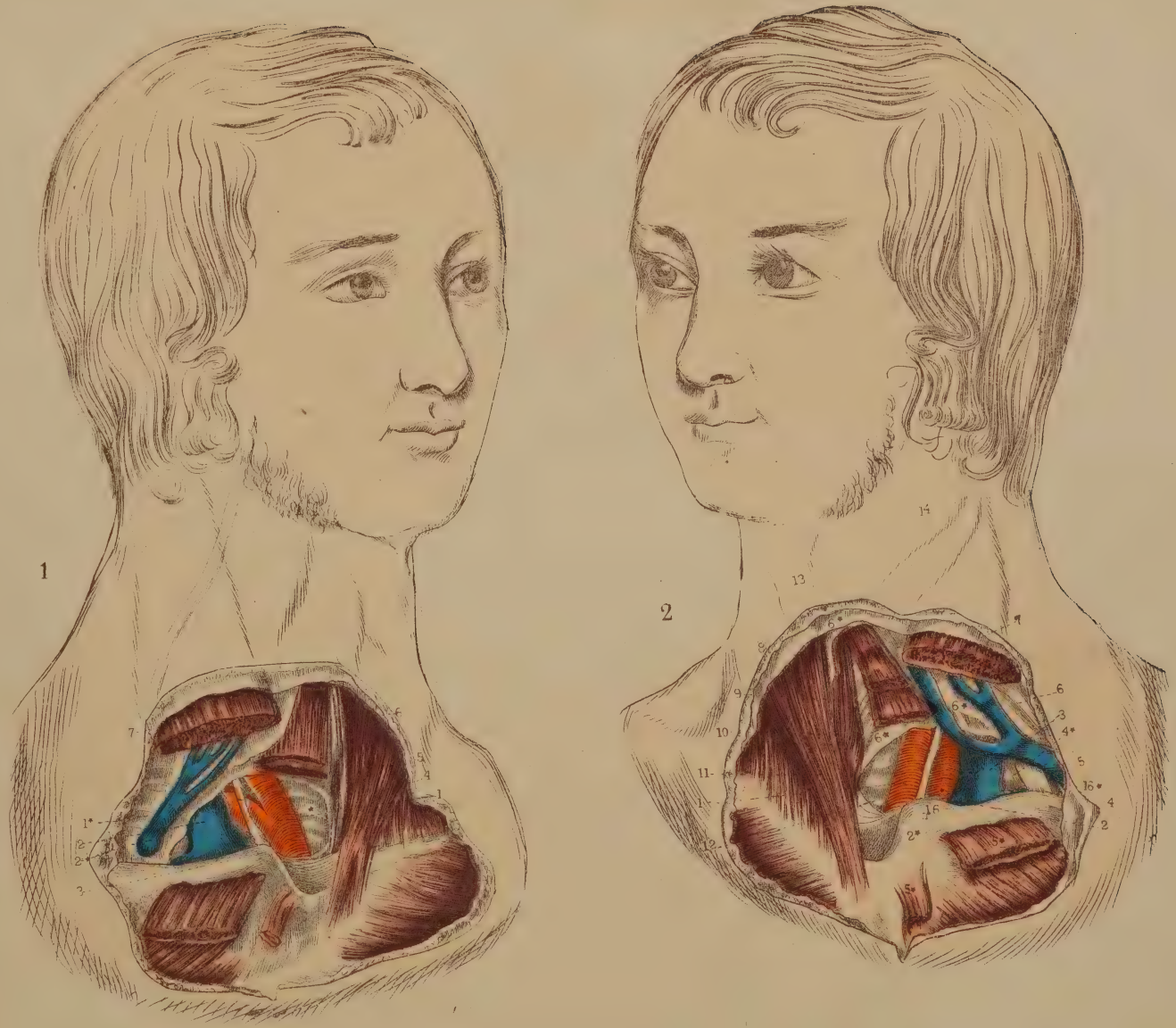
DESCRIPTION OF PLATE 4.

Figure 1.

1. Common carotid at its place of division.
2. External carotid.
3. Internal carotid, with the descending branch of the ninth nerve lying on it.
4. Facial vein entering the internal jugular vein.
5. Sterno-mastoid muscle, covered by
6. Part of the platysma muscle.
7. External jugular vein.
8. Parotid gland, sheathed over by the cervical fascia.
9. Facial vein and artery seen beneath the facial fibres of the platysma.
10. Submaxillary salivary gland.
11. Upper part of the platysma muscle cut.
12. Cervical fascia cut.
13. Sterno-hyoid muscle.
14. Omo-hyoid muscle.
15. Sterno-thyroid muscle.
16. Fascia proper of the vessels.
17. Layer of the cervical fascia beneath the sterno-mastoid muscle.
18. Portion of the same fascia.
19. External jugular vein injected beneath the skin.
20. Clavicle at the mid-point, where the subclavian artery passes beneath it.
21. Locality of the subclavian artery in the third part of its course.
22. Prominence of the trapezius muscle.
23. Prominence of the clavicular portion of the sterno-cleido-mastoid muscle.
24. Place indicating the interval between the clavicular and sternal insertions of sterno-cleido-mastoid muscle.
25. Projection of the sternal portion of the sterno-cleido-mastoid muscle.
26. Sterno-thyroid muscle.

Figure 2.

1. Clavicular attachment of the sterno-mastoid muscle lying over the internal jugular vein, etc.
2. Subclavian artery in the third part of its course.
3. Vein formed by the union of external jugular, scapular, and other veins.
4. Scalenus anticus muscle stretching over the artery, and separating it from the internal jugular vein.
5. Post-half of omo-hyoid muscle.
6. Inner branches of the brachial plexus of nerves.
7. Clavicular portion of trapezius muscle.
8. Transversalis colli artery.
9. Layer of the cervical fascia, which invests the sterno-mastoid and trapezius muscles.
10. Lymphatic bodies lying between two layers of the cervical fascia.
11. Descending superficial branches of the cervical plexus of nerves.
12. External jugular vein seen under the fascia which invests the sterno-mastoid muscle.
13. Platysma muscle cut on the body of sterno-mastoid muscle.
14. Projection of the thyroid cartilage.
15. Layer of the cervical fascia lying beneath the clavicular portion of the sterno-mastoid muscle.
16. Layer of the cervical fascia continued from the last over the subclavian artery and brachial plexus of nerves.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DESCRIPTION OF PLATE 5.

Figure 1.

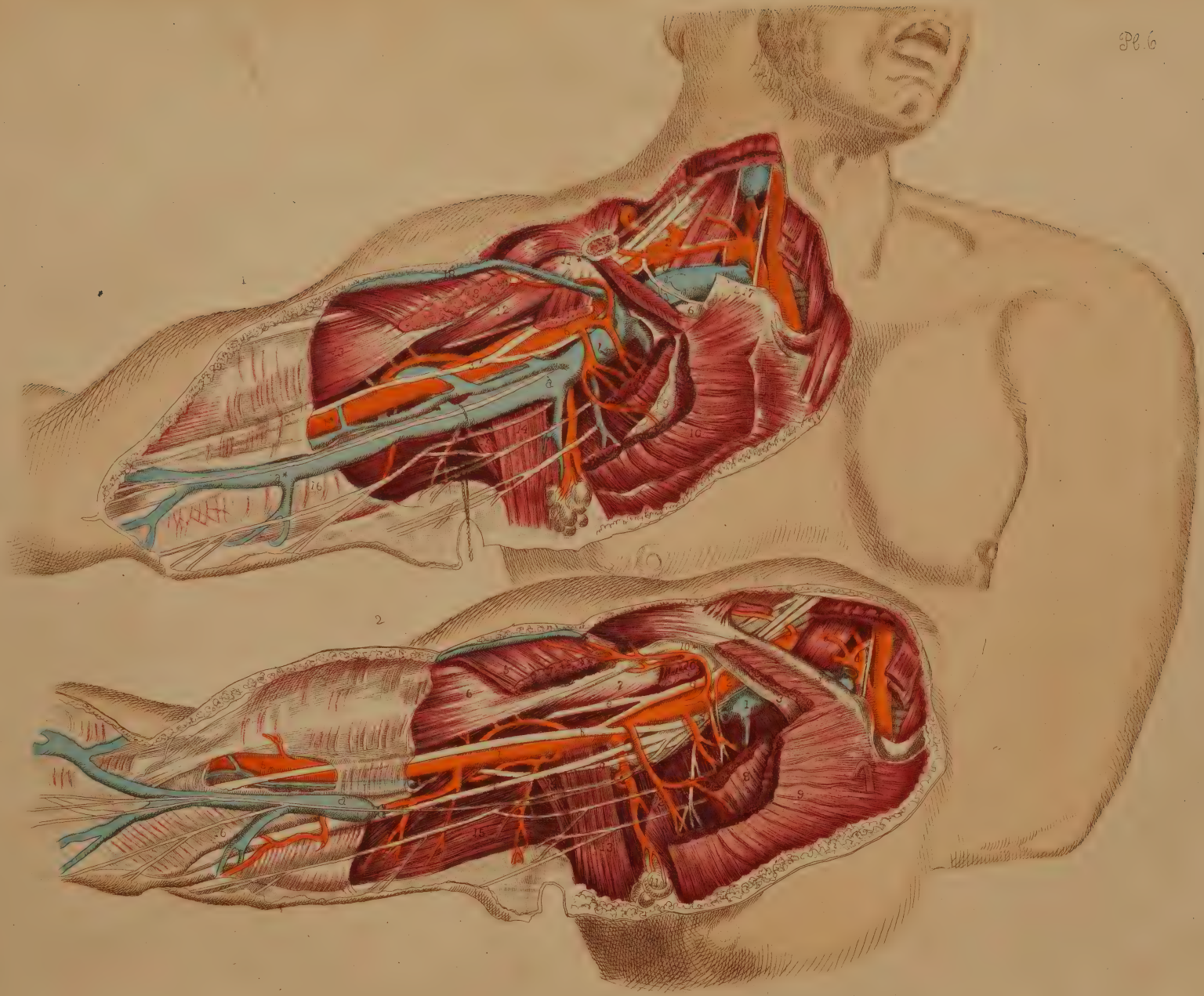
1. Innominate artery, at its point of bifurcation.
2. Right internal jugular vein, joining the subclavian vein.
3. Sternal end of the right clavicle.
4. Trachea.
5. Right sterno-thyroid muscle, cut.
5. Right sterno-hyoid muscle, cut.
7. Right sterno-mastoid muscle, cut.

1*. Right vagus nerve, crossing the subclavian artery.

2*. Anterior jugular vein, piercing the cervical fascia to join the subclavian vein.

Figure 2.

1. Common carotid artery of left side.
2. Left subclavian artery, having the vagus nerve between it and 1.
3. Lower end of left internal jugular vein, joining —
4. Left subclavian vein, which lies anterior to 4*, the scalenus anticus muscle.
5. Anterior jugular vein, coursing beneath sterno-mastoid muscle and over the fascia.
6. Deep cervical fascia, inclosing in its layers 6* 6*, the several muscles.
7. Left sterno-mastoid muscle, cut across, and separated from 5* 5*, its sternal and clavicular attachments.
8. Left sterno-hyoid muscle, cut.
9. Left sterno-thyroid muscle, cut.
10. Right sterno-hyoid muscle.
11. Right sterno-mastoid muscle.
12. Trachea.
13. Projection of the thyroid cartilage.
14. Place of division of common carotid.
15. Place where the subclavian artery passes beneath the clavicle.
16. Sternal end of the left clavicle.



DESCRIPTION OF PLATE 6.

Figure 1.

1. Subclavian vein, crossed by a branch of the brachial plexus given to the subclavius muscle; *a*, the axillary vein; *a**, the basilic vein, having the internal cutaneous nerve lying on it.
2. Subclavian artery, lying on 6, the first rib; *b*, the axillary artery; *b**, the brachial artery, accompanied by the median nerve and venæ comites.
3. Brachial plexus of nerves; 3*, the median nerve.
4. Anterior scalenus muscle.
5. Subclavius muscle.

6, 6. First rib.

7. Clavicular attachment of the deltoid muscle.
8. Humeral attachment of the great pectoral muscle.
9. A layer of fascia, encasing the lesser pectoral muscle.
10. Thoracic half of the great pectoral muscle.
11. Coracoid attachment of the lesser pectoral muscle.

11*. Coracoid process of the scapula.

12. Coraco-brachialis muscle.
13. Biceps muscle.
14. Tendon of the latissimus dorsi muscle, crossed by the intercosto-humeral nerves.
15. Teres major muscle, on which and 14 is seen lying Wrisberg's nerve.
16. Brachial fascia, investing the triceps muscle.
17. Sternal end of the clavicle.
18. Cephalic vein, coursing between the deltoid and pectoral muscles, to enter at their cellular interval into the axillary vein beneath 5, the subclavius muscle.

Figure 2.

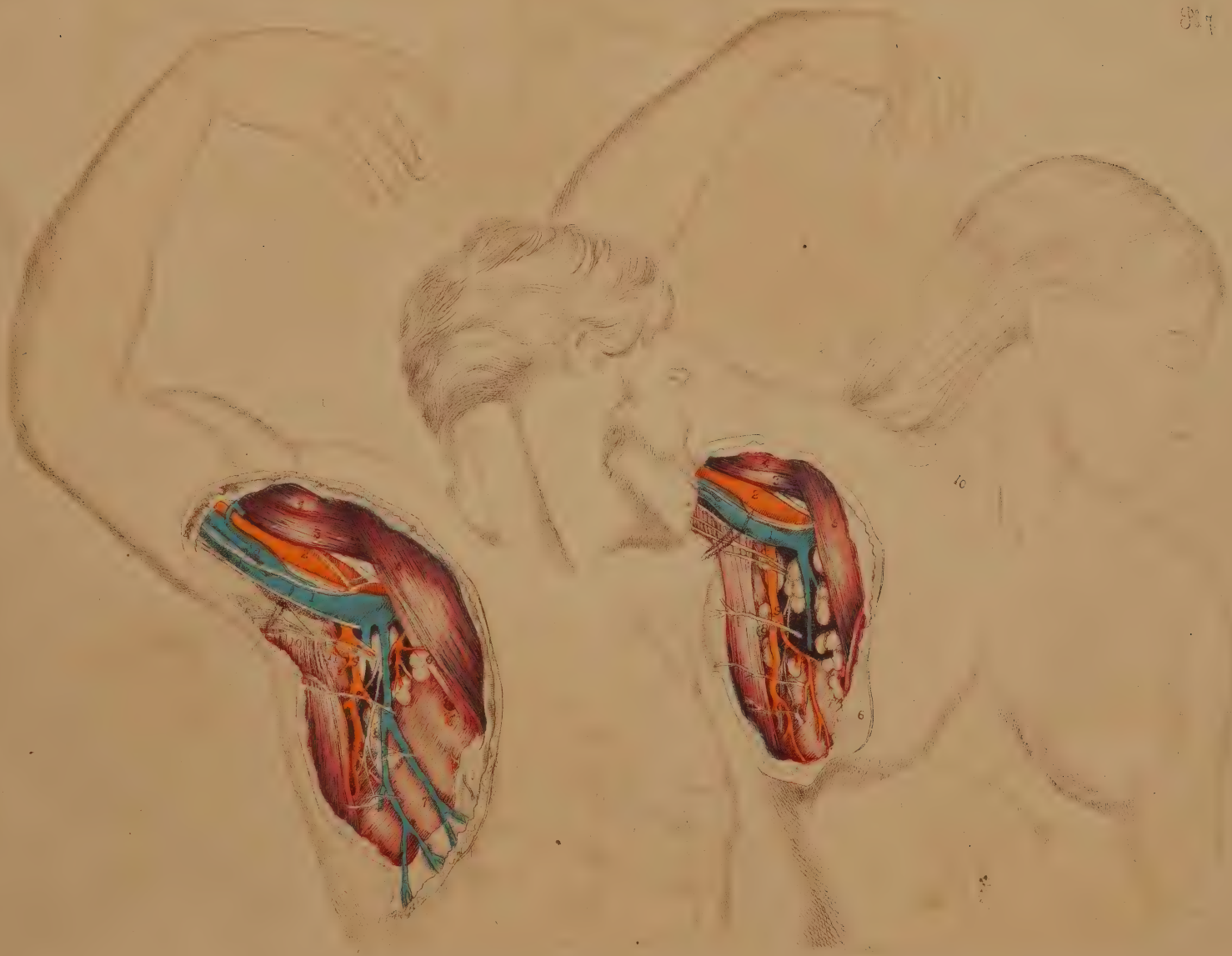
1. Axillary vein, cut and tied; *a*, the basilic vein, cut.
2. Axillary artery; *b*, brachial artery, in the upper part of its course, having *h*, the median nerve, lying rather to its outer side; *b**, the artery in the lower part of its course, with the median nerve to its inner side.
3. Subclavius muscle.

3*. Clavicle.

4. Axillary plexus of nerves, of which *d* is a branch on the coracoid border of the axillary artery; *e*, the musculo-cutaneous nerve, piercing the coraco-brachialis muscle; *f*, the ulnar nerve; *g*, musculo-spiral nerve; *h*, the median nerve; *i*, the circumflex nerve.
5. Humeral part of the great pectoral muscle.
6. Biceps muscle.
7. Coraco brachialis muscle.
8. Thoracic half of the lesser pectoral muscle.
9. Thoracic half of the greater pectoral muscle.
10. Coracoid attachment of the lesser pectoral muscle.

10*. Coracoid process of the scapula.

11. Lymphatic glands.
12. Serratus magnus muscle.
13. Latissimus dorsi muscle.
14. Teres major muscle.
15. Long head of triceps muscle.
16. Inner condyle of humerus.



DESCRIPTION OF PLATE 7.

Figure 1.

1. Axillary vein, drawn apart from the artery, to show the nerves lying between both vessels. On the bicipital border of the vein is seen the internal cutaneous nerve; on the tricipital border is the nerve of Wrisberg, communicating with some of the intercosto-humeral nerves; *a*, the common trunk of the venæ comites, entering the axillary vein.
2. Axillary artery, crossed by one root of the median nerve; *b*, basalic vein, forming, with *a*, the axillary vein, 1.
3. Coraco-brachialis muscle.
4. Coracoid head of the biceps muscle.
5. Pectoralis major muscle.
6. Pectoralis minor muscle.
7. Serratus magnus muscle, covered by *g*, the axillary fascia, and perforated, at regular intervals, by the nervous branches called intercosto-humeral.
8. Conglobate gland, crossed by the nerve called "external respiratory" of Bell, distributed to the serratus magnus muscle. This nerve descends from the cervical plexus.
9. Subscapular artery.
10. Tendon of latissimus dorsi muscle.
11. Teres major muscle.

Figure 2.

1. Axillary vein.
2. Axillary artery.
3. Coraco-brachialis muscle.
4. Short head of the biceps muscle.
5. Pectoralis major muscle.
6. Mammary gland, seen in section.
7. Serratus magnus muscle.
8. Lymphatic gland; *h h*, other glands of the lymphatic class.
9. Subscapular artery, crossed by the intercosto-humeral nerves and descending parallel to the external respiratory nerve. Beneath the artery is seen a subscapular branch of the brachial plexus, given to the latissimus dorsi muscle.
10. Locality of the subclavian artery.
11. Locality of the brachial artery at the bend of the elbow.

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11. Locality of the brachial artery at the bend of the elbow.

Pl. 8

DESCRIPTION OF PLATE 8.

FIGURE 1.

1. Fascia covering the biceps muscle.
2. Basilic vein, with the internal cutaneous nerve.
3. Brachial artery, with the venæ comites.
4. Cephalic vein, with the external cutaneous nerve; *d*, the median nerve.
5. A communicating vein, joining the venæ comites.
6. Median basilic vein.
7. Lymphatic gland.
8. Radial artery at its middle.
9. Radial artery of the pulse.
10. Ulnar artery, with ulnar nerve.
11. Palmaris brevis muscle.

FIGURE 2.

1. Biceps muscle.
2. Basilic vein, cut.
3. Brachial artery.
4. Median nerve; *d*, the ulnar nerve.
5. Brachialis anticus muscle; *e*, the internal condyle.
6. Origin of radial artery.
7. Supinator radii longus muscle.
8. Aponeurosis of the tendon of the biceps muscle.
9. Pronator teres muscle.
10. Flexor carpi ulnaris muscle.
11. Flexor carpi radialis muscle.
12. Palmaris longus muscle.
13. Radial artery, at its middle, with the radial nerve on its outer side.
14. Flexor digitorum sublimis.
15. Flexor pollicis longus.
16. Median nerve.
17. Lower end of radial artery.
18. Lower end of ulnar artery, in company with the ulnar nerve.
19. Pisiform bone.
20. Extensor metacarpi pollicis.

PL 9

DESCRIPTION OF PLATE 9.

Figure 1.

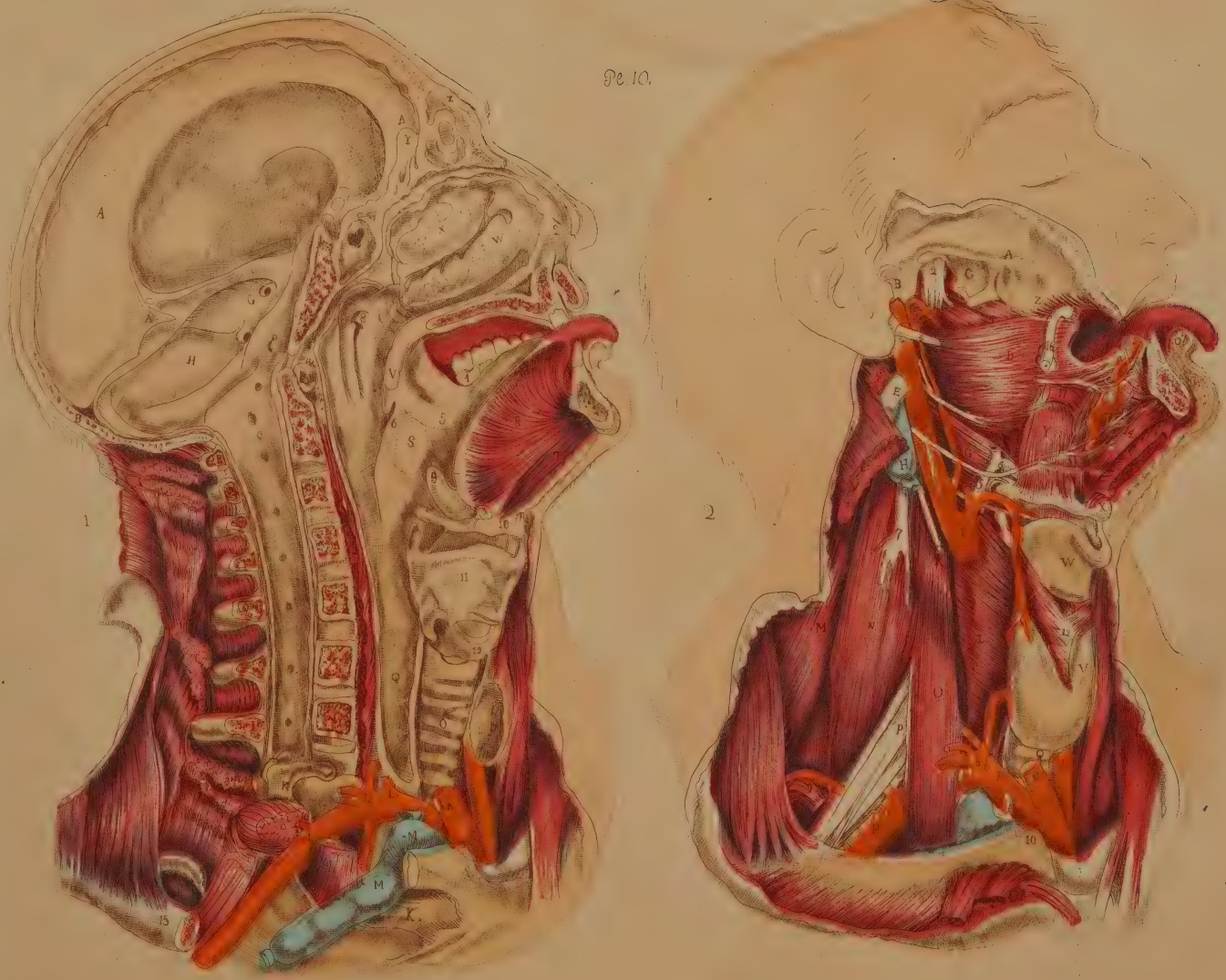
1. Radial artery.
2. Median nerve; *b b b b*, its branches to the thumb and fingers.
3. Ulnar artery, forming 6, the superficial palmar arch.
4. Ulnar nerve; 5 5, its continuation branching to the little and ring fingers.
7. Pisiform bone.
8. Abductor muscle of the little finger.
9. Tendon of flexor carpi radialis muscle.
10. Opponens pollicis muscle.
11. Flexor brevis muscle of the little finger.
12. Flexor brevis pollicis muscle.
13. Abductor pollicis muscle.
14. Lumbricales muscles.
15. Tendons of the flexor digitorum sublimis muscle.
16. Tendon of the flexor longus pollicis muscle.
17. Tendon of extensor metacarpi pollicis.
18. Tendons of flexor digitorum sublimis; 15, their digital prolongations.
19. Tendon of flexor carpi ulnaris.
20. Union of the digital arteries at the tip of the finger.

Figure 2.

1. Radial artery.
2. Tendons of the extensors of the thumb.
3. Tendon of extensor carpi radialis.
4. Annular ligament.
5. Deep palmar arch, formed by radial artery giving off *e*, the artery of the thumb.
6. Pisiform bone.
7. Ulnar artery, giving off the branch 9, to join the deep palmar arch 5, of the radial artery.
8. Ulnar nerve; *h*, superficial branches given to the fingers. Its deep palmar branch is seen lying on the interosseous muscles, 12.
10. Abductor minimi digiti.
11. Flexor brevis minimi digiti.
12. Palmar interosseal muscles.
13. Tendons of flexor digitorum sublimis and profundus, and the lumbricales muscles cut and turned down.
14. Tendon of flexor pollicis longus.
15. Carpal end of the metacarpal bone of the thumb.

Figure 3.

1. Tendons of extensor digitorum communis; 1*, tendon overlying that of the indicator muscle.
2. Dorsal part of the annular ligament.
3. End of the radial nerve distributed over the back of the hand, to two of the fingers and the thumb.
4. Dorsal branch of the ulnar nerve supplying the back of the hand and the three outer fingers.
5. Radial artery turning round the carpal end of the metacarpal bone of the thumb.
6. Tendon of extensor carpi radialis brevis.
7. Tendon of extensor carpi radialis longus.
8. Tendon of third extensor of the thumb.
9. Tendon of second extensor of the thumb.
10. Tendon of extensor minimi digiti joining a tendon of extensor communis.



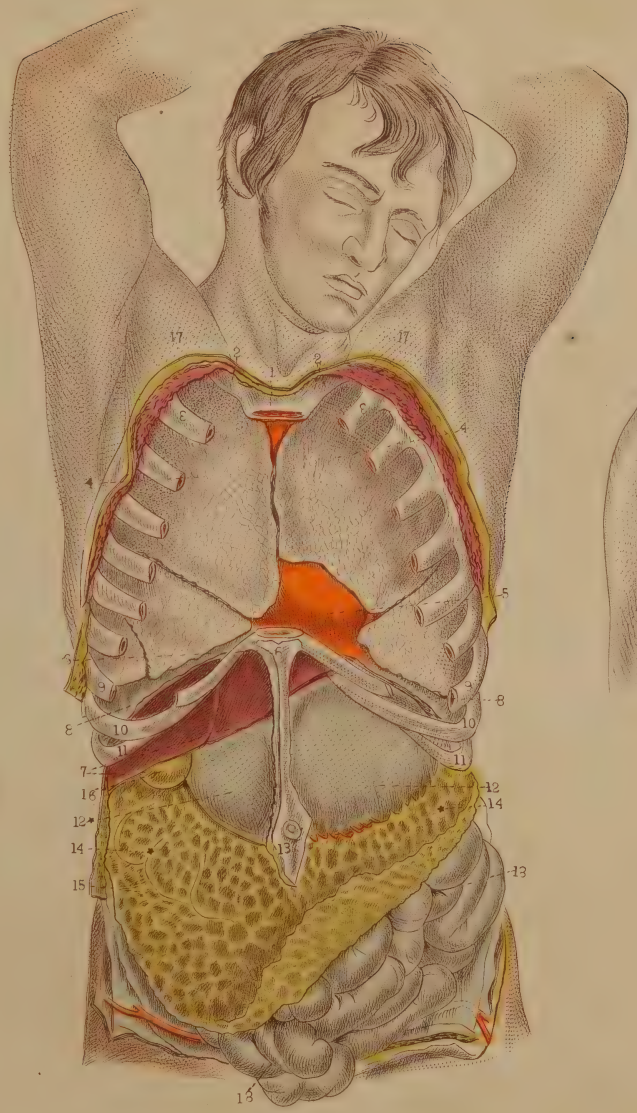
DESCRIPTION OF PLATE 10.

Figure 1.

A A. The dura-matral falx; A*, its attachment to the tentorium.
B. Torcular Herophili.
C. Dura-mater lining the spinal canal.
D D*. Axis vertebra.
E E*. Atlas vertebra.
F F*. Basilar processes of the sphenoid and occipital bones.
G. Petrous part of the temporal bone.
H. Cerebellar fossa.
I I*. Seventh cervical vertebra.
K K*. First rib surrounding the upper part of the pleural sac.
L L*. Subclavian artery of the right side overlying the pleural sac.
M M*. Right subclavian vein.
N. Right common carotid artery cut at its origin.
O. Trachea.
P. Thyroid body.
Q. Œsophagus.
R. Genio-hyo-glossus muscle.
S. Left tonsil beneath the mucous membrane.
T. Section of the lower maxilla.
U. Section of the upper maxilla.
V. Velum paliti in section.
W. Inferior spongy bone.
X. Middle spongy bone.
Y. Crista galli of œthmoid bone.
Z. Frontal sinus.
2. Anterior cartilaginous part of nasal septum.
3. Nasal bone.
4. Last molar tooth of the left side of lower jaw.
5. Anterior pillar of the fauces.
6. Posterior pillar of the fauces.
7. Genio-hyoid muscle.
8. Opening of Eustachian tube.
9. Epiglottis.
10. Hyoid bone.
11. Thyroid bone.
12. Cricoid bone.
13. Thyroid axis.
14. Part of anterior scalenus muscle.
15. Humeral end of the clavicle.
16. Part of posterior scalenus muscle.

Figure 2.

A. Zygoma.
B. Articular glenoid fossa of temporal bone.
C. External pterygoid process lying on the levator and tensor palati muscles.
D. Superior constrictor of pharynx.
E. Transverse process of the Atlas.
F. Internal carotid artery. Above the point F, is seen the glosso-pharyngeal nerve; below F, is seen the hypoglossal nerve.
G. Middle constrictor of pharynx.
H. Internal jugular vein.
I. Common carotid cut across.
K. Rectus capitis major muscle.
L. Inferior constrictor of pharynx.
M. Levator anguli scapulæ muscle.
N. Posterior scalenus muscle.
O. Anterior scalenus muscle.
P. Brachial plexus of nerves.
Q. Trachea.
R R*. Subclavian artery.
S. End of internal jugular vein.
T. Bracheo-cephalic artery.
U U*. Roots of common carotid arteries.
V. Thyroid body.
W. Thyroid cartilage.
X. Hyoid bone.
Y. Hyo-glossus muscle.
Z. Upper maxillary bone.
2. Inferior maxillary branch of fifth cerebral nerve.
3. Digastric muscle, cut.
4. Styloid process.
5. External carotid artery.
6, 6. Lingual artery.
7. Roots of cervical plexus of nerves.
8. Thyroid axis; 8*, thyroid artery, between which and Q, the trachea, is seen the inferior laryngeal nerve.
9. Omo-hyoid muscle cut.
10. Sternal end of clavicle.
11. Upper rings of trachea, which may with most safety be divided in tracheotomy.
12. Cricoid cartilage.
13. Crico-thyroid interval where laryngotomy is performed.
14. Genio-hyoid muscle.
15. Section of lower maxilla.
16. Parotid duct.
17. Lingual attachment of styloglossus muscle, with part of the gustatory nerve seen above it.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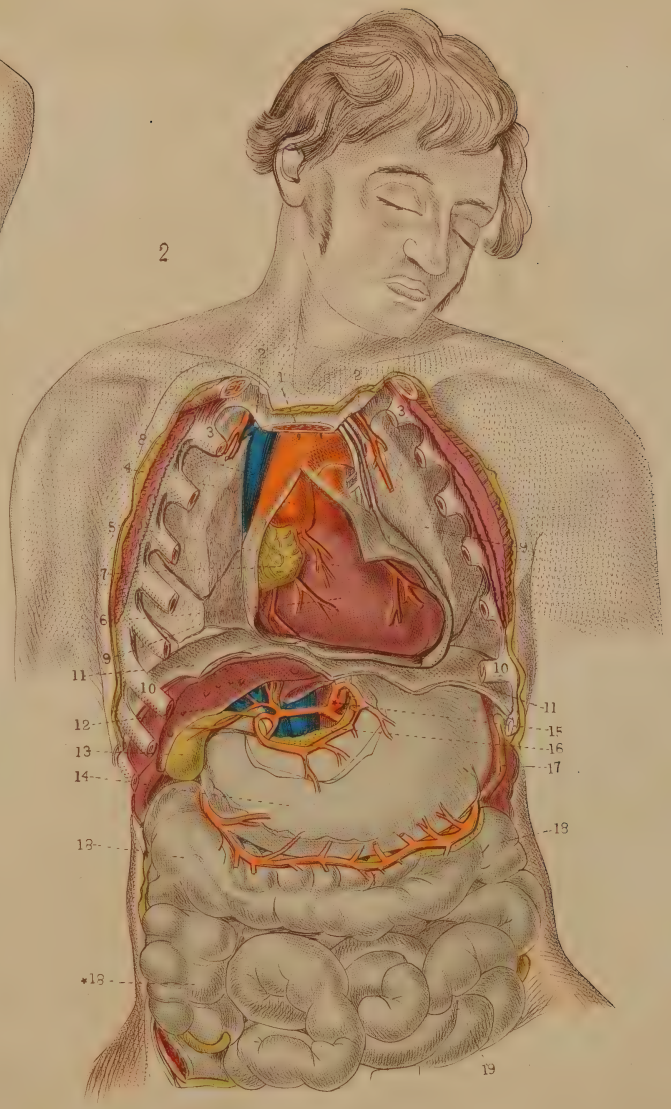
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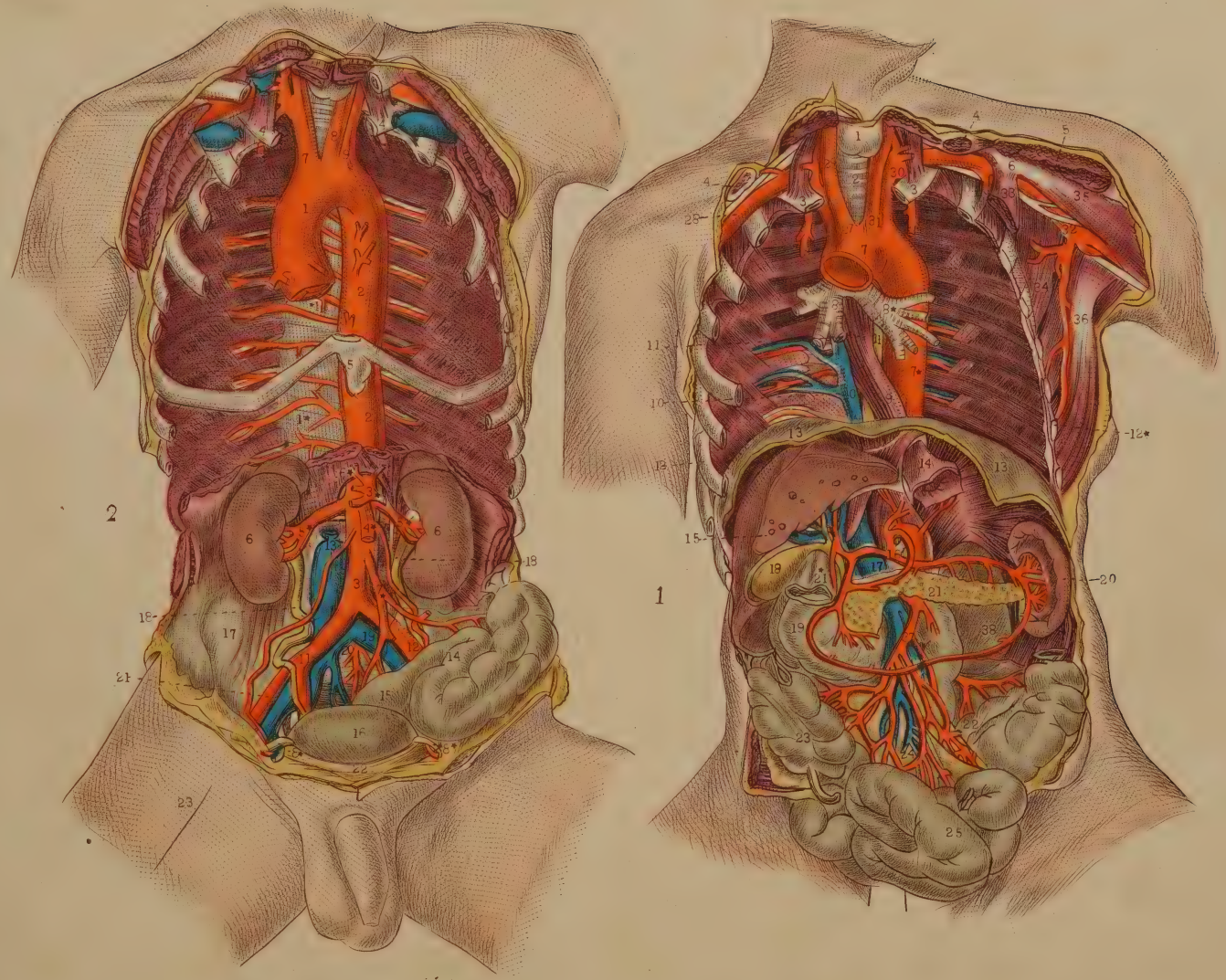
DESCRIPTION OF PLATE 11.

Figure 1.

1. Upper bone of the sternum.
2, 2. Two first ribs.
3, 3. Second pair of ribs.
4, 4. Right and left lungs.
5. Pericardium, enveloping the heart, — the right ventricle.
6. Lower end of the sternum.
7, 7. Lobes of the liver.
8, 8. Right and left halves of the diaphragm in section. The right half separating the right lung from the liver; the left half separating the left lung from the broad cardiac end of the stomach.
9, 9. Eighth pair of ribs.
10, 10. Ninth pair of ribs.
11, 11. Tenth pair of ribs.
12, 12. The stomach; 12, its cardiac bulge; 12*, its pyloric extremity.
13. The umbilicus.
14*. Situation of the transverse colon.
15. The omentum, covering the transverse colon and small intestines.
16. The gall bladder.
17, 17. The right and left pectoral prominences.
18, 18. Small intestines.

Figure 2.

1. Upper end of the sternum.
2. First pair of ribs.
3. Second pair of ribs.
4. Aorta, with left vagus and phrenic nerves crossing its transverse arch.
5. Root of pulmonary artery.
6. Right ventricle.
7. Right auricle.
8. Vena cava superior, with right phrenic nerve on its outer border.
9. Right and left lungs collapsed and turned outwards, to show the heart's outline.
10. Seventh pair of ribs.
11. The diaphragm in section.
12. The liver in section.
13. The gall bladder with its duct joining the hepatic duct to form the common bile duct. The hepatic artery is seen superficial to the common duct; the vena portæ is seen beneath it. The patent orifices of the hepatic veins are seen on the cut surface of the liver.
14. The stomach.
15. The cœliac axis dividing into the coronary, splenic, and hepatic arteries.
16. Inferior vena cava.
17. The spleen.
18, 18. The transverse colon, between which and the lower border of the stomach is seen the gastro-epiploic artery, formed by the splenic and hepatic arteries.
18*. Ascending colon in the right iliac region.
19. Convolutions of the small intestines distended with air.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DESCRIPTION OF PLATE 12.

Figure 1.

1. The thyroid body.
2. The trachea.
3, 3. The first ribs.
4, 4. The clavicles, cut at their middle.
5. Humeral part of the great pectoral muscle, cut.
6. The coracoid process of the scapula.
7. The arch of the aorta. 7*. Descending aorta in the thorax.
8. Right bronchus. 8*. Left bronchus.
9. Œsophagus.
10. Vena azygos receiving the intercostal veins.
11. Thoracic duct.
12, 12*. Seventh ribs.
13. The diaphragm, in section.
14. The cardiac orifice of the stomach.
15. The liver, in section, showing the patent orifices of the hepatic veins.
16. The cœliac axis sending off branches to the liver, stomach, and spleen. The stomach has been removed, to show the looping anastomosis of these vessels around the superior and inferior borders of the stomach.
17. The inferior vena cava about to enter its notch in the posterior thick part of the liver, to receive the hepatic veins.
18. The gall-bladder, communicating by its duct with the hepatic duct, which is lying upon the vena portæ, and by the side of the hepatic artery.

21*. The pyloric end of the stomach, joining 19, the duodenum.

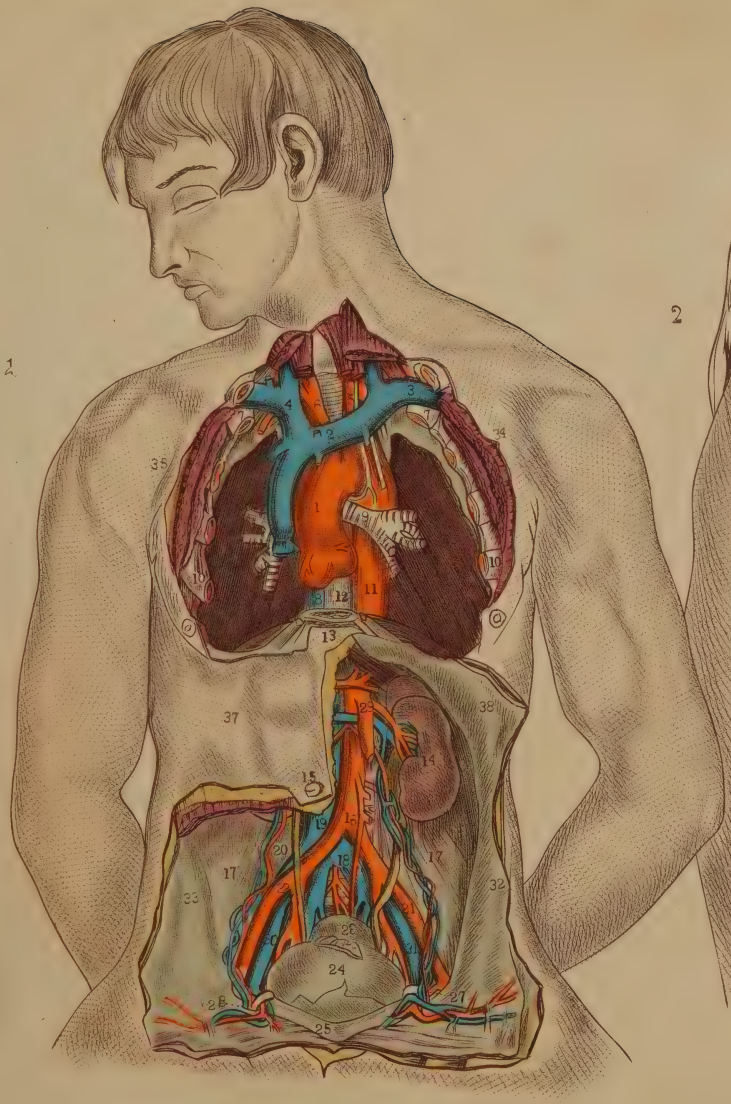
21. The spleen.
22. The pancreas.
23. The sigmoid flexure of the colon.
24. The caput coli.
25. The mesentery, supporting the numerous looping branches of the superior mesenteric artery.
26. Some coils of the small intestine.
27. Innominate artery.
28. Right subclavian artery.
29. Right common carotid artery.
30. Left subclavian artery.
31. Left common carotid artery.
32. Left axillary artery.
33. Coracoid attachment of the smaller pectoral muscle.
34. Subscapular muscle.
35. Coracoid head of the biceps muscle.
36. Tendon of the latissimus dorsi muscle.
37. Superior mesenteric artery, with its accompanying vein.
38. Left kidney.

Figure 2.

1. The arch of the aorta.
2. The descending thoracic part of the aorta, giving off the intercostal arteries.
3. The abdominal part of the aorta.
4. First pair of ribs.
5. The xyphoid cartilage.
6. The right and left kidneys.
7. The brachio-cephalic artery.
8. Left common carotid artery.
9. Left subclavian artery.
11. Right common iliac artery at its place of division.
12. Left common iliac artery, seen through the meso-rectum.
13. Inferior vena cava.
14. The sigmoid flexure of the colon.
15. The rectum.
16. The urinary bladder.
17. The right iliac fossa.
18. The right and left ureters.
19. The left common iliac vein, joining the right under the right common iliac artery to form the inferior vena cava.
20. Fifth lumbar vertebra.
21. The external iliac artery of right side.
22. The symphysis pubis.
23. An incision made over the locality of the femoral artery.

1*. The dorsal intercostal arteries.

3*. The cœliac axis.
4*. The superior mesenteric artery.
5*. The renal arteries.
7*. The inferior mesenteric artery.
8*. The vas deferens bending over the epigastric artery and the os pubis, after having passed through the internal abdominal ring.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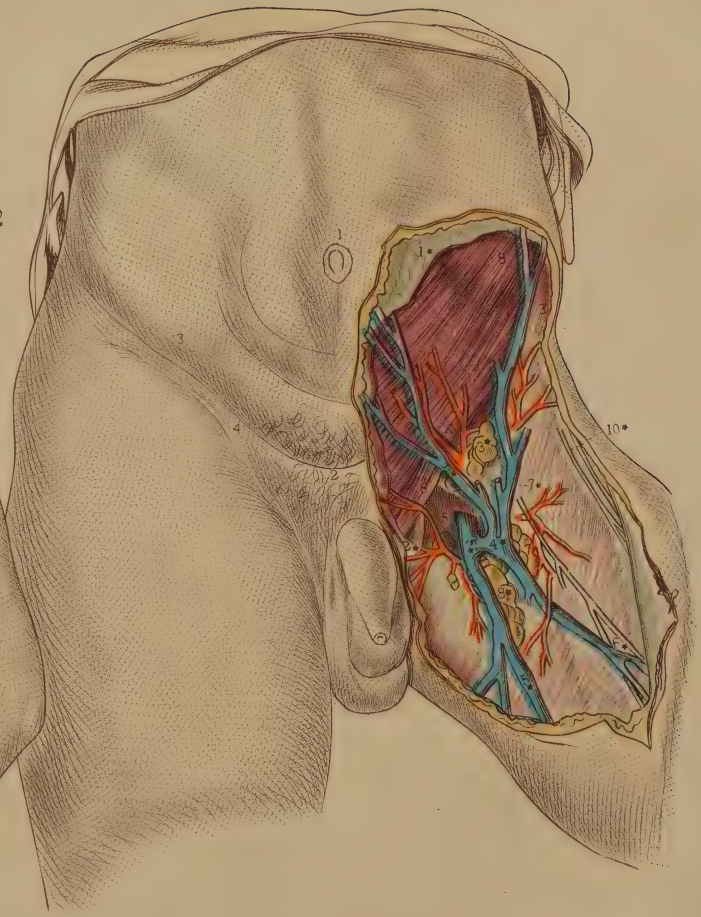
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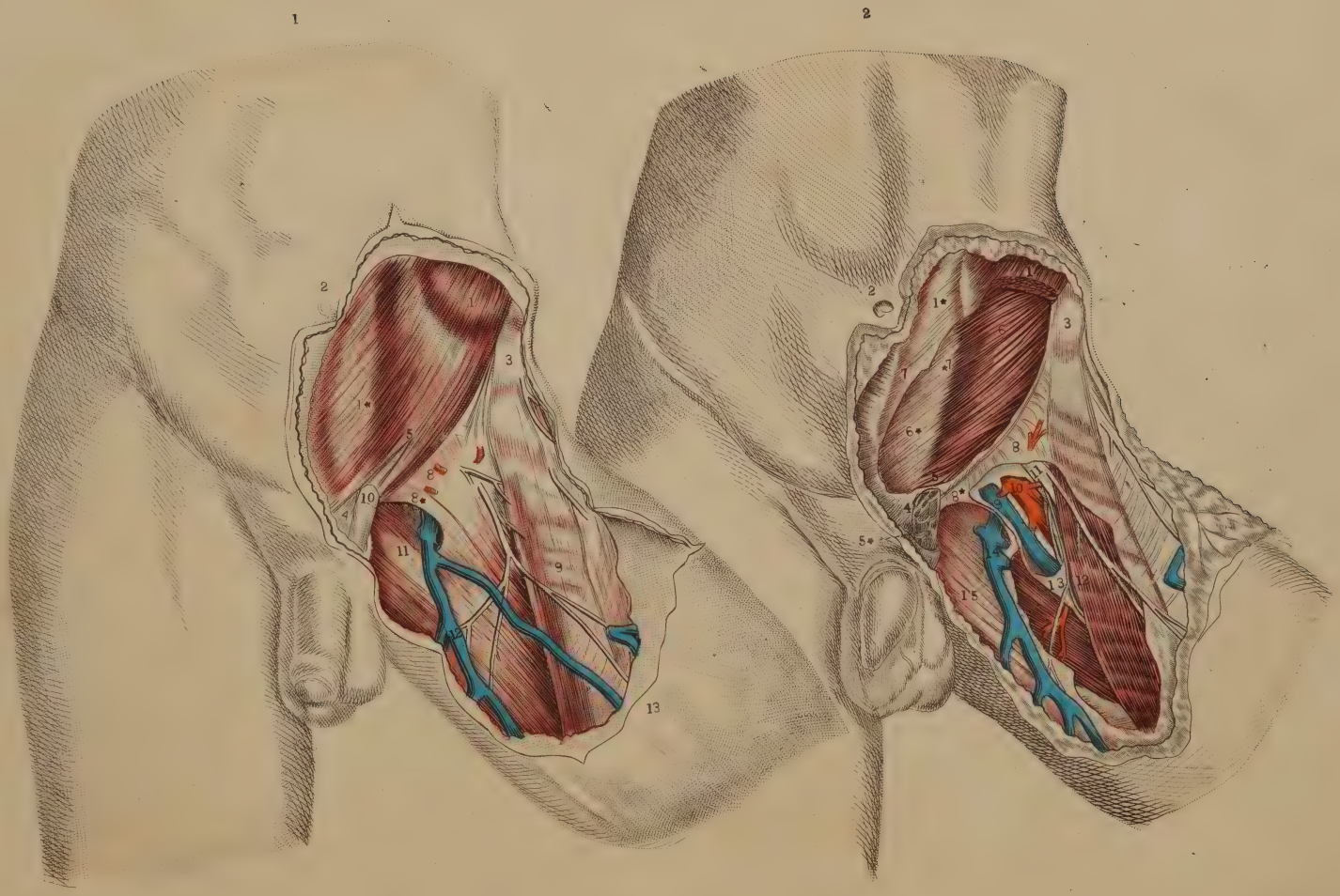
DESCRIPTION OF PLATE 13.

Figure 1.

1. The systemic aorta. Owing to the body being inclined forwards, the root of the aorta appears to approach too near the lower boundary (13) of the thorax.
2. The left brachio-cephalic vein.
3. Left subclavian vein.
4. Right brachio-cephalic vein.
5. Left common carotid artery.
6. Brachio-cephalic artery.
7. The first pair of ribs.
8. Superior vena cava.
9. Left bronchus.
10. Fourth pair of ribs.
11. Descending thoracic aorta.
12. Œsophagus.
13. Epigastrium.
14. Left kidney.
15. Umbilicus.
16. Abdominal aorta, at its bifurcation.
17. Right and left iliac fossæ.
18. Left common iliac vein.
19. Inferior vena cava.
20. Psoas muscle, supporting the right spermatic vessels.
21. Left external iliac artery crossed by the left ureter.
22. Right external iliac artery crossed by the right ureter.
23. The rectum.
24. The urinary bladder, which being fully distended, and viewed from above, gives it the appearance of being higher than usual above the pubic symphysis.
25. Pubic symphysis.
27. The left internal abdominal ring complicated with the epigastric vessels, the vas deferens, and the spermatic vessels.
28. The right internal abdominal ring in connection with the like vessels and duct as that of left side.
29. Superior mesenteric artery.
30, 31. Right and left external iliac veins.
32, 33. Situations of the anterior superior iliac spinous processes.
34, 35. Situations of the coracoid processes.
37, 38. Right and left hypochondriac regions.

Figure 2.

1. The umbilicus.
2. The upper margin of the pubic symphysis.
3. The anterior superior spines of the iliac bones.
4. The point where, in this subject, the cord manifested itself beneath the fibres of the external oblique muscle.
5. The saphenous opening in the fascia lata, receiving 5*, the saphenous vein.
6. The lax and pendulous cord which, in this case, overlies the upper part of the saphenous opening.
7. Lymphatic glands lying on the fascia lata in the neighborhood of the saphenous opening.
8. The fleshy part of the external oblique muscle.
1*. The superficial fascia of the abdomen.
2*. The same fascia forming an envelope for the spermatic cord and scrotum.
3*. Inguinal glands lying near Poupart's ligament.
4*. A common venous trunk, formed by branches from the thigh and abdomen, and joining —
5*. The saphenous vein.
6*. The middle cutaneous nerve, derived from the anterior crural nerve.
8*. Femoral lymphatic glands.
7*. Superficial external iliac vein.
9*. Superficial epigastric vein.
10*. External cutaneous branches of nerves from the lumbar plexus.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DESCRIPTION OF PLATE 14.

Figure 1.

1. The fleshy part of the external oblique muscle; 1*, its tendon covering the rectus muscle.
2. The umbilicus.
3. The anterior superior spinous process of the ilium.
4. The spinous process of the os pubis.
5. The point where in this instance the fibres of the aponeurotic tendon of the external oblique muscle begin to separate and form the pillars of the external ring.

6, 7. See Figure 29.

8. The fascia lata — its iliac portion. The letter indicates the situation of the common femoral artery; 8*, the falciform edge of the saphenous opening.
9. The sartorius muscle covered by a process of the fascia lata.
10. The spermatic fascia derived from the external oblique tendon.
11. The pubic part of the fascia lata forming the inner and posterior boundary of the saphenous opening.
12. The saphenous vein.
13. A tributary vein coming from the fore part of the thigh.

Figure 2.

1. The muscular part of the external oblique; 1*, its tendon.
2. The umbilicus.
3. The anterior superior iliac spine.
4. The spine of the os pubis.
5. The cremasteric fibres, within the external ring, surrounding the cord; 5*, the cremasteric fibres looping over the cord outside the ring.
6. The muscular part of the internal oblique giving off, E, the cremaster; its tendon sheathing the rectus muscle.
7. The linea alba; 6*, 7*, the linea semilunaris.
8. The iliac part of the fascia lata; 8*, the upper cornu of its falciform process.
9. The femoral vein.
10. The femoral artery.
11. The anterior crural nerve.
12. The sartorius muscle.
13. The sheath of the femoral vessels.
14. The saphena vein.
15. The pubic part of the fascia lata.

PL.15.

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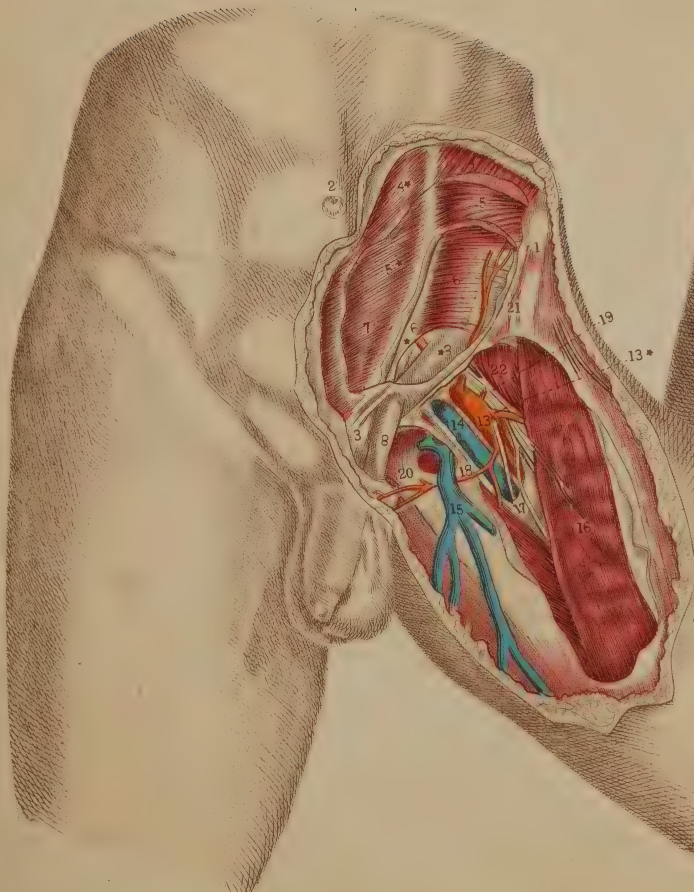

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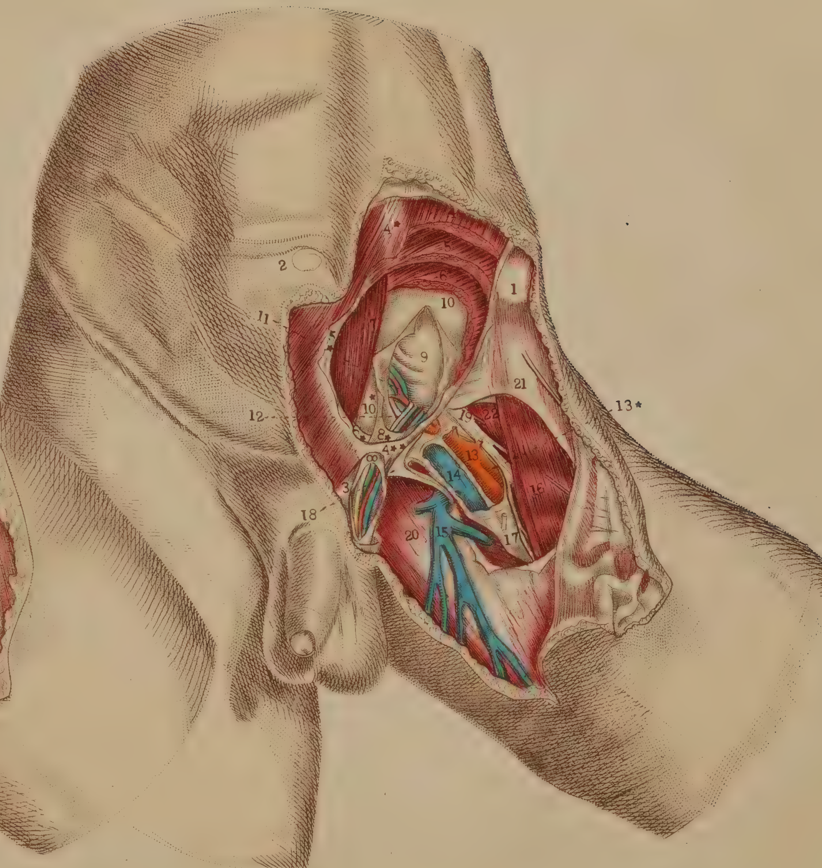

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DESCRIPTION OF PLATE 15.

Figure 1.

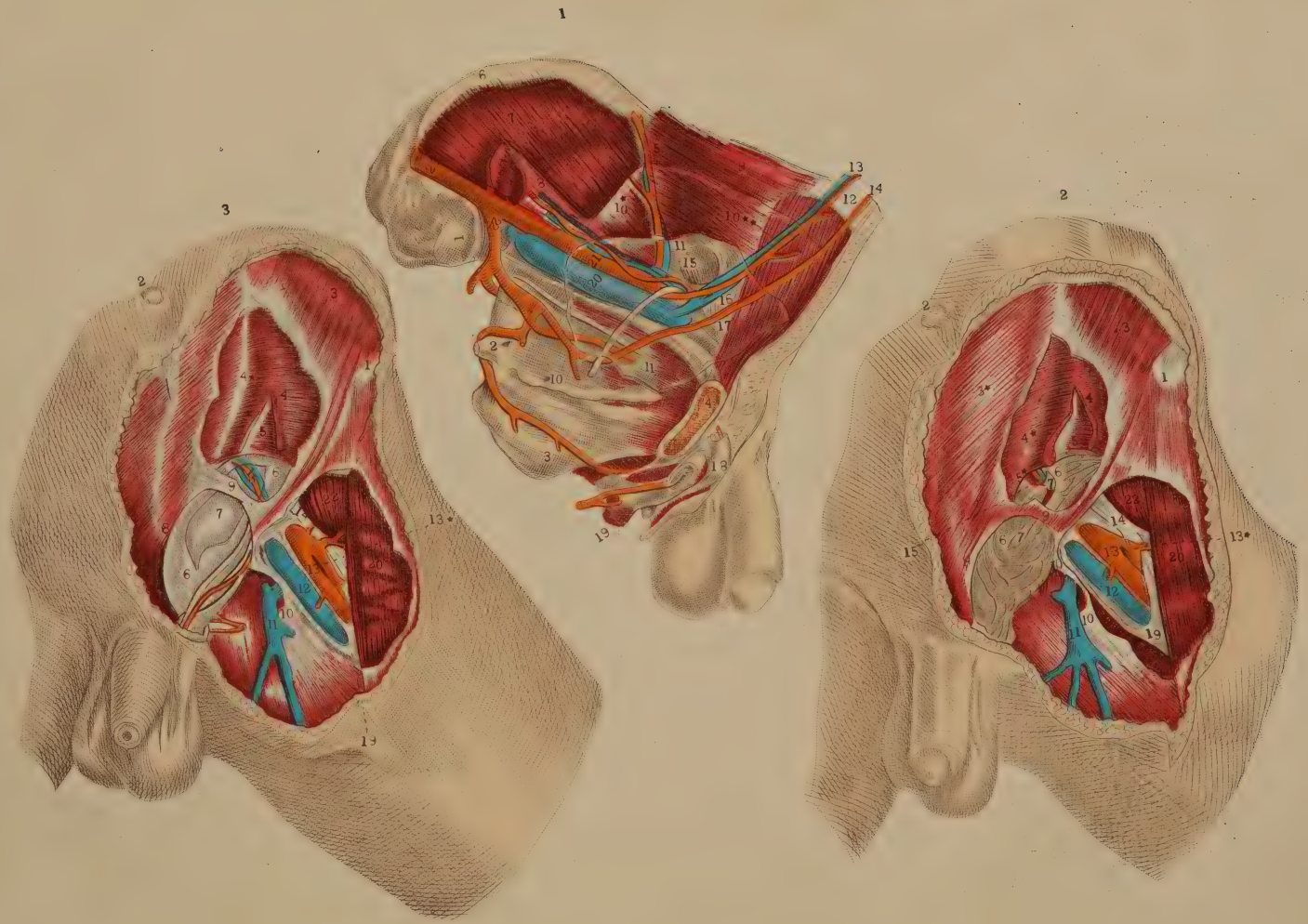
1. The anterior superior iliac spine.
2. The umbilicus.
3. The spine of the pubis.
4. The external oblique muscle; 4*, its tendon.
5. The internal oblique muscle; 5*, its tendon.
6. The transverse muscle; 6*, its tendon, forming, with 5* the conjoined tendon.
7. The rectus muscle enclosed in its sheath.
8. The fascia spermatica interna covering the cord; 8*, its funnel-shaped extremity.

9, 10, 11, 12. See Figure 2.

13. The femoral artery; 13*, its profunda branch.
14. The femoral vein.
15. The saphena vein.
16. The sartorious muscle.
17. The sheath of the femoral vessels.
18. The falciform margin of the saphenous opening.
19. The anterior crural nerve.
20. The pubic portion of the fascia lata.
21. The iliac portion attached to Poupart's ligament.
22. The lower part of the iliacus muscle.

Figure 2.

1. The anterior superior iliac spine.
2. The umbilicus.
3. The spine of the pubis.
4. The external oblique muscle; 4*, its tendon; 4** the external ring.
5. The internal oblique muscle.
6. The transverse muscle; 6*, its tendon; forming, with 5*, the conjoined tendon.
7. The rectus muscle laid bare.
8. The fascia spermatica interna laid open above and below 4*, the external ring.
9. The peritonæum closing the internal ring.
10. The fascia transversalis; 10*, its pubic part.
11. The epigastric artery and veins.
12. The spermatic artery, veins, and vas deferens, bending round the epigastric artery at the internal ring.
13. The femoral artery; 13*, its profunda branch.
14. The femoral vein, joined by —
15. The saphena vein.
16. The sartorious muscle.
17. The sheath of the femoral vessels.
18. The falciform margin of the saphenous opening.
19. The anterior crural nerve.
20. The pubic part of the fascia lata.
21. The iliac part of the fascia lata.
22. The lower part of the iliacus muscle.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DESCRIPTION OF PLATE 16.

FIGURE 1.

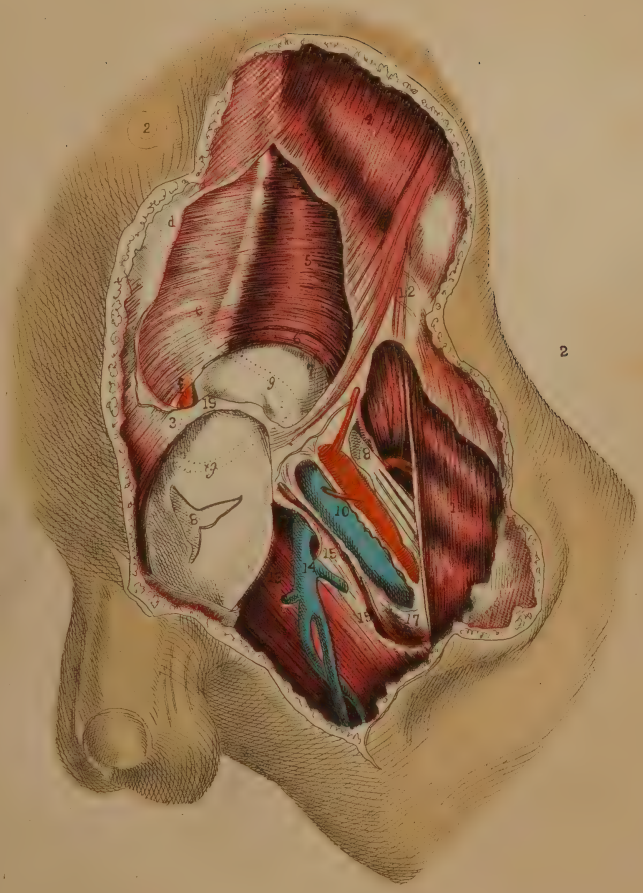
1. That part of the ilium which abuts against the sacrum.
2. The spine of the ischium.
3. The tuberosity of the ischium.
4. The symphysis pubis.
5. Situation of the anterior superior iliac spine.
6. Crest of the ilium.
7. Iliacus muscle.
8. Psoas magnus muscle supporting the spermatic vessels.
9. Transversalis muscle.
12. Termination of the sheath of the rectus muscle.
10, 10*, 10**. The iliac, transverse, and pelvic portions of the transversalis fascia.
11. The peritonæum lining the groin.
13. The epigastric vessels lying between the peritonæum, 11, and the transversalis fascia, 10*.
14. The umbilical ligament.
15. The neck of the sac of an external inguinal hernia formed before the spermatic vessels.
16. An interval which occasionally occurs between the unbilical ligament and the epigastric artery.
17 and 18. Situations where the direct inguinal hernia occurs when, as in this case, the unbilical ligament crosses the space named the internal fossa, — the triangle of Hesselbach.
19. Lower part of the right spermatic cord.
20. The bulb of the uretha.
21. External iliac vein covered by the peritonæum.
22. External iliac artery covered by the peritonæum.
23. Internal iliac artery.
24. Common iliac artery.

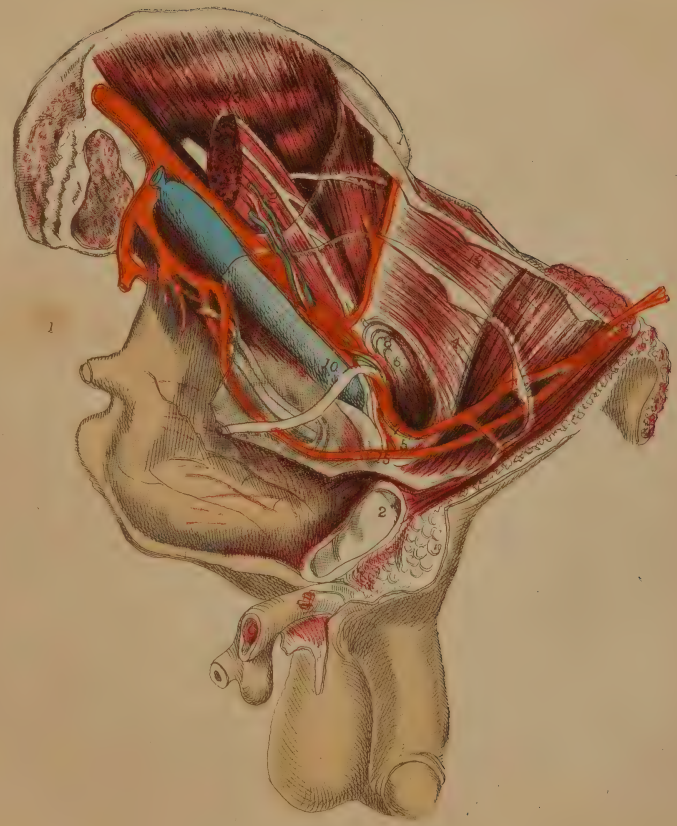
FIGURE 2. — *The External Inguinal Hernia.*

1. Anterior iliac spinous process.
2. The umbilicus.
3. Fleshy part of the external oblique muscle; 3*, its tendon.
4. Fleshy part of the internal oblique muscle; 3*, its tendon.
5. Transversalis muscle; 5*, the conjoined tendon.
6. The funnel-shaped sheath of the spermatic vessels covering the external hernia; upon it are seen the cremasteric fibres.
7, 7. The peritonæal covering or sac of the external hernia within the sheath.
9. The external abdominal ring.
8. The crista pubis.
10, 10. The saphenous opening.
11. The saphena vein.
12. The femoral vein.
13. The femoral artery; 13*, its profunda branch.
14. The anterior crural nerve.
15. The epigastric vessels overlaid by the neck of the hernia.
19. The sheath of the femoral vessels.
20. The sartorious muscle.
22. The iliacus muscle.

FIGURE 3. — *The Internal Inguinal Hernia.*

The figures indicate the same parts as in Figure 2.





DESCRIPTION OF PLATE 17.

Figure 1.

1. Anterior superior spine of the ilium; *a*, indicates the situation of the middle of Poupart's ligament.
2. Symphysis pubis.
3. Rectus abdominis muscle covered by the fascia transversalis.
4. The peritonæum lining the groin.
5. The situation of the conjoined tendon resisting the further progress of the external hernia gravitating inwards.
6. A dotted line indicating the original situation of the epigastric artery in the external hernia.
7. The new position assumed by the epigastric artery borne inwards by the weight of the old external hernia.
8. The original situation of the neck of the sac of the external hernia.
9. The new situation assumed by the neck of the sac of an old external hernia which has gravitated inwards from its original place at 8.
10. The external iliac vein covered by the peritonæum.
11. The external iliac artery covered by the peritonæum and crossed by the spermatic vessels.
12. The psoas muscle supporting the spermatic vessels and the genito-crural nerve.
13. The iliacus muscle.
14. The transversalis fascia lining the transverse muscle.

Figure 2. — An Anterior View of Figure 1.

1. Anterior superior iliac spinus process.
2. The navel.
3. The situation of the crista pubis.
4. The external oblique muscle; *d*, its tendon.
5. Internal oblique muscle; *e*, its tendon, covering the rectus muscle.
6. Lower part of the transverse muscle; *f*, the conjoined tendon.
7. The transversalis fascia investing the upper part of the hernial sac; *g*, the original situation of the epigastric artery internal to this hernia; *g**, the new situation of the artery pushed inwards.
8. The hernial sac, invested by *h*, the elongation of the fascia transversalis, or funnel-shaped sheath.
9. The femoral artery.
10. The femoral vein.
11. The sartorius muscle.
12. Iliac part of the fascia lata joining Poupart's ligament.
13. Pubic part of the fascia lata.
14. Saphena vein.
15. Falciform margin of the saphenous opening.
16. See Plate 18, Figure 2.
17. Sheath of the femoral vessels.
18. Anterior crural nerve.
19. The external ring.

PL. 18.

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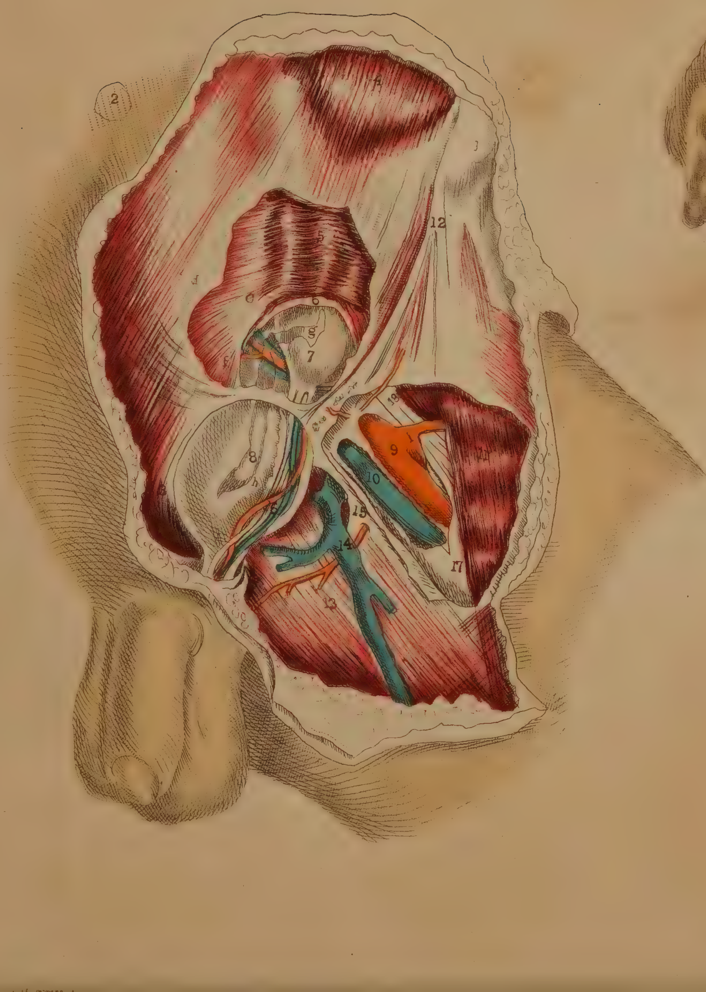

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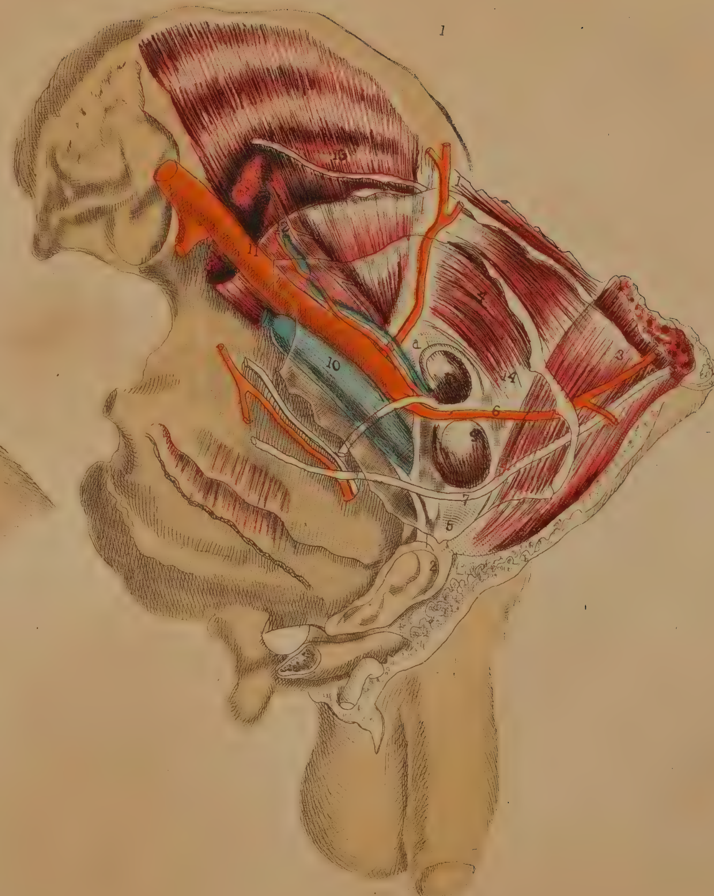

DESCRIPTION OF PLATE 18.

Figure 1.

All the figures except the following indicate the same parts as in Figure 1, Plate 17.

6. The epigastric artery passing between the two hernial sacs.
7. The umbilical ligament.
8. The neck of the sac of the external hernia.
9. The neck of the sac of the internal hernia.

Figure 2. — An Anterior View of Figure 1.

All the letters, with the exception of the following, refer to the same parts as in Plate 17, Figure 2.

7. The funnel-shaped elongation of the fascia transversalis receiving *g*, the sac of the external bubonocele.
8. The sac of the internal inguinal hernia invested by *h*, the transversalis fascia.
6. The spermatic vessels lying on the outer side of H, the direct inguinal hernia.


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SURGICAL ANATOMY.

PLATE 19.

DEMONSTRATIONS OF THE NATURE OF CONGENITAL AND INFANTILE INGUINAL HERNIÆ, AND OF HYDROCELE.

PLATE 19. Fig. 1. — *The descent of the testicle from the loins to the scrotum.* — The fœtal abdomen and scrotum form one general cavity, and are composed of parts which are structurally identical. The cutaneous, fascial, muscular, and membranous layers of the abdominal parietes are continued into those of the scrotum. At the fifth month of fœtal life, the testicle, 3, is situated in the loins beneath the kidney, 2. The testicle is then numbered amongst the abdominal viscera, and, like these, it is developed external to the peritonæal membrane, which forms an envelope for it. At the back and sides of the testicle, where the peritonæum is reflected from it, a small membranous fold or mesentery (mesorchium, *Seiler*) is formed, and between the layers of this the nerves and vessels enter the organ, the nerves being derived from the neighboring sympathetic ganglia (aortic plexus), while the arteries and veins spring directly from the main abdominal blood vessels. It being predetermined that the testicle, 3, should migrate from the loins to the scrotum, 6 *a*, 7, at a period included between the sixth and ninth month, certain structural changes are at this time already effected for its sure and easy passage. By the time that the testis, 5, is about to enter the internal inguinal ring, 6 *a*, (seventh or eighth month), a process or pouch of the peritonæal membrane (processus vaginalis) has already descended through this aperture into the scrotum, and the testicle follows it.

The descent of the testis is effected by a very slow and gradual process of change. (Tout va par degrès dans la nature, et rien par sauts. — *Bonnet.*) But how, or by what distinct and active structural agent, this descent is effected, or whether there does exist, in fact, any such agent as that which anatomists name "gubernaculum testis," are questions which appear to me by no means settled.*

The general lining membrane of the fœtal abdomen is composed of two layers — an outer one of fibrous, and an inner one of serous structure. Of these two layers, the abdominal viscera form for themselves a double envelope.† The testis in the loins has a covering from both membranes, and is still found to be inclosed by both, even when it has descended to the scrotum. The two coverings of fibro-serous structure which surrounded the testis in the

*Dr. Carpenter (Principles of Human Physiology) remarks, that "the cause of this descent is not very clear. It can scarcely be due merely, as some have supposed, to the contraction of the gubernaculum, since that does not contain any fibrous structure until after the lowering of the testis has commenced." Dr. Sharpey (Quain's Anatomy, 5th edition) observes, that "the office of the gubernaculum is yet imperfectly understood." The opinions of these two distinguished physiologists will doubtless be regarded as an impartial estimate of the results of the researches prosecuted in reference to these questions by Haller, Camper, Hunter, Arnaud, Lobstein, Meckel, Paletta, Wrisberg, Vicq d'Azyr, Brugnone, Tumiati, Seiler, Girardi, Cooper, Bell, Weber, Carus, Cloquet, Curling, and others. From my own observations, I am led to believe that no such muscular structure as a gubernaculum exists, and therefore that the descent of the testis is the effect of another cause. Leaving these matters, however, to the consideration of the physiologist, it is sufficient for the surgeon to know that the testis in its transition derives certain coverings from the parietes of the groin, and that a communication is thereby established between the scrotal and abdominal cavities.

†Langenbeck describes the peritonæum as consisting of two layers; one external and fibrous, another internal and serous. By the first, he means, I presume, that membrane of which the transversalis and iliac fasciæ are parts. (See Comment. de Periton. Structura, etc.)

loins become respectively the tunica albuginea and tunica vaginalis when the gland occupies the scrotal cavity.

PLATE 119, Fig. 2. — *The testicle in the scrotum.* — When the testicle, 5, descends into the scrotum, 7, which happens in general at the time of birth, the abdomino-scrotal fibro-serous membrane, 6 *a*, 6 *d*, is still continuous at the internal ring, 6 *b*. From this point downwards to a level with the upper border of the testicle, the canal of communication between the scrotal cavity and the abdomen becomes elongated and somewhat constricted. At this part, the canal itself consists, like the abdominal membrane above and the scrotal membrane below, of a fibrous and serous layer, the latter enclosed within the former. The serous lining of this canal is destined to be obliterated, while the outer fibrous membrane is designed to remain in its primitive condition. When the serous canal contracts and degenerates to the form of a simple cord, it leaves the fibrous canal still continuous above with the fibrous membrane (transversalis fascia) of the abdomen, and below with the fibrous envelope (tunica albuginea) of the testis; and at the adult period, this fibrous canal is known as the internal spermatic sheath, or infundibuliform fascia enclosing the remains of the serous canal, together with the spermatic vessels, &c.

PLATE 19, Fig. 3. — *The serous tunica vaginalis is separated from the peritonæum.* — When the testicle, 7, has descended to the scrotum, the serous tube or lining of the inguinal canal and cord, 6 *b*, 6 *c*, closes and degenerates into a simple cord, (infantile spermatic cord,) and thereby the peritonæal sac, 6 *a*, becomes distinct from the serous tunica vaginalis, 6 *d*. But the fibrous tube, or outer envelope of the inguinal canal, remains still pervious, and continues in this condition throughout life. In the adult, we recognise this fibrous tube as the infundibuliform fascia of the cord, or as forming the fascia propria of an external inguinal hernia. The anterior part of the fibrous spermatic tube descends from the fascia transversalis; the posterior part is continuous with the fascia iliaca. In relation to the testicle, the posterior part will be seen to be reflected over the body of the gland as the tunica albuginea, while the anterior part blends with the cellular tissue of the front wall of the scrotum. The tunica vaginalis, 6 *d*, is now traceable as a distinct sac,* closed on all sides, and reflected from the fore part of the testicle, above and below, to the posterior aspect of the front wall of the scrotum.

PLATE 19, Fig. 4. — *The abdomino-scrotal serous lining remains continuous at the internal ring, and a congenital hydrocele is formed.* — When the serous spermatic tube, 6 *b*, 6 *c*, remains pervious and continuous above with the peritonæum, 6 *a*, and below with the serous tunica vaginalis, 6 *d*, the serous fluid of the abdomen will naturally gravitate to the most depending part — viz., the tunica vaginalis; and thus a hydrocele is formed. This kind of hydrocele is named congenital, owing to the circumstance that the natural process of obliteration, by which the peritonæum becomes separated from the tunica vaginalis, has been, from some cause, arrested.* As long as the canal of communication, 6 *b*, 6 *c*, between the tunica vaginalis, 6 *d*, and the peritonæum 6 *a*, remains pervious, which it may be throughout life, this form of hydrocele is, of course, liable to occur. It may be diagnosed from diseased enlargements of the testicle, by its transparency, its fluctuation, and its smooth, uniform fulness and shape, besides its being of less weight than a diseased testis of the same size would be. It may be distinguished from the common form of hydrocele of the isolated tunica vaginalis by the fact, that pressure made on the scrotum will cause the fluid to pass freely into the general cavity of the peritonæum. As the fluid distends the tunica vaginalis, 6 *c*, 6 *d*, in front of the testis, this organ will of course lie towards the back of the scrotum, and therefore, if it be found necessary to evacuate the fluid, the puncture may be made with most safety in front of the scrotum. If ascites should form in an adult in whom the tunica vaginalis still communicates with the peritonæal sac, the fluid which accumulates in the latter membrane will also distend the former, and all the collected fluid may be evacuated by tapping the scrotum. When a hydrocele is found to be congenital, it must be at once obvious that to inject irritating fluids into the tunica vaginalis (the radical cure) is inadmissible. In an adult, free from all structural disease, and in whom a congenital hydrocele is occasioned by the gravitation of the ordinary serous secretion of the peritonæum, a cure may be effected by causing the obliteration of the serous spermatic canal by the pressure of a truss. When a congenital hydrocele happens in an infant in whom the testicle, 5, Fig. 1, Plate 19, is arrested in the inguinal canal,†

*Mr. Owen states that the Chimpanzee alone, amongst brute animals, has the tunica vaginalis as a distinct sac.

* The serous spermatic tube remains open in all quadrupeds; but their natural prone position renders them secure against hydrocele or hernial protrusion. It is interesting to notice how in man, and the most anthropo-morphous animals, where the erect position would subject these to the frequent accident of hydrocele or hernia, nature causes the serous spermatic tube to close.

† In many quadrupeds (the Rodentia and Monotremes) the testes remain within the abdomen. In the Elephant, the testes always

if pressure be made on this passage with a view of causing its closure, the testicle will be prevented from descending.

PLATE 19, Fig. 5. — *The serous spermatic canal closes imperfectly, so as to become sacculated, and thus a hydrocele of the cord is formed.*—After the testicle, 7, has descended to the scrotum, the sides of the serous tube, or lining of the inguinal canal and cord, 6 *b*, 6 *c*, may become adherent at intervals; and the intervening sacs of serous membrane continuing to secrete their proper fluid, will occasion a hydrocele of the cord. This form of hydrocele will differ according to the varieties in the manner of closure; and these may take place in the following modes: 1st, if the serous tube close only at the internal ring, 6 *a*, while the lower part of it, 6 *b*, 6 *c*, remains pervious, and communicating with the tunica vaginalis, 6 *d*, a hydrocele will be formed of a corresponding shape; 2d, if the tube close at the upper part of the testicle, 6 *c*, thus isolating the tunica vaginalis, 6 *d*, while the upper part, 6 *b*, remains pervious, and the internal ring, 6 *a*, open, and communicating with the peritonæal sac, a hydrocele of the cord will happen distinct from the tunica vaginalis; or this latter may be, at the same time, distended with fluid, if the disposition of the subject be favorable to the formation of dropsy; 3d, the serous tube may close at the internal ring, form sacculi along the cord, and close again at the top of the testicle, thus separating the tunica vaginalis from the abdomen, and thereby several isolated hydroceles may be formed. If in this condition of the parts we puncture one of the sacs for the evacuation of its contents, the others, owing to their separation, will remain distended.

PLATE 19, Fig. 6. — *Hydrocele of the isolated tunica vaginalis.* — When the serous spermatic tube, 6 *b*, 6 *c*, becomes obliterated, according to the normal rule, after the descent of the testicle, 7, the tunica vaginalis, 6 *d*, is then a distinct serous sac. If a hydrocele form in this sac, it may be distinguished from the congenital variety by its remaining undiminished in bulk when the subject assumes the horizontal position, or when pressure is made on the tumor, for its contents cannot now be forced into the abdomen. The testicle, 7, holds the same position in this as it does in the congenital hydrocele.* The radical cure may be performed here without endangering the peritonæal sac. Congenital hydrocele is of a cylindrical shape; and this is mentioned as distinguishing it from isolated hydrocele of the tunica vaginalis, which is pyriform; but this mark will fail when the cord is at the same time distended, as it may be, in the latter form of the complaint.

PLATE 19, Fig. 7. — *The serous spermatic tube remaining pervious, a congenital hernia is formed.* — When the testicle, 7, has descended to the scrotum, if the communication between the peritonæum, 6 *a*, and the tunica vaginalis, 6 *c*, be not obliterated, a fold of the intestine, 13, will follow the testicle, and occupy the cavity of the tunica vaginalis, 6 *d*. In this form of hernia (hernia tunicæ vaginalis, *Cooper*), the intestine is in front of, and in immediate contact with, the testicle. The intestine may descend lower than the testicle, and envelope this organ so completely as to render its position very obscure to the touch. This form of hernia is named congenital, since it occurs in the same condition of the parts as is found in congenital hydrocele, — viz: the inguinal ring remaining unclosed. It may occur at any period of life, so long as the original congenital defect remains. It may be distinguished from hydrocele by its want of transparency and fluctuation. The impulse which is communicated to the hand applied to the scrotum of a person affected with scrotal hernia, when he is made to cough, is also felt in the case of congenital hydrocele. But in hydrocele of the separate tunica vaginalis, such impulse is not perceived. Congenital hernia and hydrocele may co-exist; and, in this case, the diagnostic signs which are proper to each, when occurring separately, will be so mingled as to render the precise nature of the case obscure.

PLATE 19, Figure 8. — *Infantile hernia.* — When the serous spermatic tube becomes merely closed, or obliterated at the inguinal ring, 6 *b*, the lower part of it, 6 *c*, is pervious, and communicating with the tunica vaginalis,

occupy their original position beneath the kidneys, in the loins. Human adults are occasionally found to be "testiconde;" the testes being situated below the kidneys, or at some part between this position and the internal inguinal ring. Sometimes only one of the testes descends to the scrotum.

* When a hydrocele is interposed between the eye and a strong light, the testis appears as an opaque body at the back of the tunica vaginalis. But this position of the organ is, from several causes, liable to vary. The testis may have become morbidly adherent to the front wall of the serous sac, in which case the hydrocele will distend the sac laterally. Or the testis may be so transposed in the scrotum, that, whilst the gland occupies its front part, the distended tunica vaginalis is turned behind. The tunica vaginalis, like the serous spermatic tube, may, in consequence of inflammatory fibrinous effusion, become sacculated-multilocular, in which case, if a hydrocele form, the position of the testis will vary accordingly. — See Sir Astley Cooper's work, ("Anatomy and Diseases of the Testis,") Morton's "Surgical Anatomy;" Mr. Curling's "Treatise on Diseases of the Testis;" and also his article "Testicle," in the Cyclopædia of Anatomy and Physiology.

6 *d*. In consequence of the closure of the tube at the inguinal ring, if a hernia now occur, it cannot enter the tunica vaginalis, and come into actual contact with the testicle. The hernia, 13, therefore, when about to force the peritonæum, 6 *a*, near the closed ring, 6 *b*, takes a distinct sac or investment from this membrane. This hernial sac, 6 *e*, will vary as to its position in regard to the tunica vaginalis, 6 *d*, according to the place whereat it dilates the peritonæum at the ring. The peculiarity of this hernia, as distinguished from the congenital form, is owing to the scrotum containing two sacs, — the tunica vaginalis and the proper sac of the hernia; whereas, in the congenital variety, the tunica vaginalis itself becomes the hernial sac by a direct reception of the naked intestine. If in infantile hernia a hydrocele should form in the tunica vaginalis, the fluid will also distend the pervious serous spermatic tube, 6 *c*, as far up as the closed internal ring, 6 *b*, and will thus invest and obscure the descending herniary sac, 13. This form of hernia is named infantile (*Hey*), owing to the congenital defect in that process, whereby the serous tube lining the cord is normally obliterated. Such a form of hernia may occur at the adult age for the first time, but it is still the consequence of original default.

Plate 19, Figure 9. — *Oblique inguinal hernia in the adult.* — This variety of hernia occurs not in consequence of any congenital defect, except inasmuch as the natural weakness of the inguinal wall opposite the internal ring may be attributed to this cause. The serous spermatic tube has been normally obliterated for its whole length between the internal ring and the tunica vaginalis; but the fibrous tube, or spermatic fascia, is open at the internal ring where it joins the transversalis fascia, and remains pervious as far down as the testicle. The intestine, 13, forces and distends the upper end of the closed serous tube; and as this is now wholly obliterated, the herniary sac, 6 *c*, derived anew from the inguinal peritonæum, enters the fibrous tube, or sheath of the cord, and descends it as far as the tunica vaginalis, 6 *d*, but does not enter this sac, as it is already closed. When we compare this hernia, Fig. 9, Plate 19, with the infantile variety, Fig. 8, Plate 19, we find that they agree in so far as the intestinal sac is distinct from the tunica vaginalis; whereas the difference between them is caused by the fact of the serous cord remaining in part pervious in the infantile hernia; and on comparing Figure 9, Plate 19, with the congenital variety, Figure 7, Plate 19, we see that the intestine has acquired a new sac in the former, whereas, in the latter, the intestine entered the tunica vaginalis. The variable position of the testicle in Figs. 7, 8, and 9, Plate 19, is owing to the variety in the anatomical circumstances under which these herniæ have happened.

PLATE 20.

DEMONSTRATIONS OF THE ORIGIN AND PROGRESS OF INGUINAL HERNIÆ IN GENERAL.

PLATE 20, Fig. 1. — When the serous spermatic tube is obliterated for its whole length between the internal ring, 1, and the top of the testicle, 13, a hernia, in order to enter the inguinal canal, 1 4, must either rupture the peritonæum at the point 1, or dilate this membrane before in the form of a sac.* If the peritonæum at the point 1 be ruptured by the intestine, this latter will enter the fibrous spermatic tube, 2 3, and will pass along this tube devoid of the serous sac. If, on the other hand, the intestine dilates the serous membrane at the point, 1, where it stretches across the internal ring, it will, on entering the fibrous tube, (infundibuliform fascia,) be found invested by a sac of the peritonæum, which it dilates and pouches before itself. As the epigastric artery, 9, bends in general along the internal border of the ring of the fibrous tube, 2 2, the neck of the hernial sac which enters the ring at a point external to the artery must be external to it, and remain so despite all further changes in the form, position, and dimensions of the hernia. And as this hernia enters the ring at a point anterior to the spermatic vessels, its neck must be anterior to them. Again, if the bowel be invested by a serous sac, formed of the peritonæum at the point 1, the neck of such sac must intervene between the protruding bowel and the epigastric and spermatic vessels. But if the intestine enter the ring of the fibrous tube, 2 2, by having ruptured the peritonæum at the point 1, then the naked intestine will lie in immediate contact with these vessels.

PLATE 20, Fig. 2. — When the serous spermatic tube, 11, remains pervious between the internal ring, 1, (where it communicates with the general peritonæal membrane,) and the top of the testicle, (where it opens into the tunica vaginalis,) the bowel enters this tube directly, without a rupture of the peritonæum at the point 1. This tube, therefore, becomes one of the investments of the bowel. It is the serous sac, not formed by the protruding bowel, but one already open to receive the bowel. This is the condition necessary to the formation of congenital hernia. This hernia must be one of the external oblique variety, because it enters the open abdominal end of the infantile serous spermatic tube, which is always external to the epigastric artery. Its position in regard to the spermatic vessels is the same as that noticed in Fig. 1, Plate 20. But, as the serous tube through which the congenital hernia descends, still communicates with the tunica vaginalis, so will this form of hernia enter this tunic, and thereby become different to all other herniæ, forasmuch as it will lie in immediate contact with the testicle.*

PLATE 20, Fig. 3. — The infantile serous spermatic tube, 11, sometimes remains pervious in the neighborhood of the internal ring, 1, and a narrow tapering process of the tube (the canal of Nuck) descends within the fibrous tube, 2 3, and lies in front of the spermatic vessels and epigastric artery. Before this tube reaches the testicle, it degenerates into a mere filament, and thus the tunica vaginalis has become separated from it as a distinct sac. When the bowel enters the open abdominal end of the serous tube, this latter becomes the hernial sac. It is not possible to distinguish by any special character a hernia of this nature, when already formed, from one which occurs in the condition of parts proper to Fig. 1, Plate 20, or that which is described in the note to Fig. 2, Plate 20; for when the intestine dilates the tube, 11, into the form of a sac, this latter assumes the exact shape of the sac, as noticed in Fig. 1, Plate 20. The hernia in question cannot enter the tunica vaginalis. Its position in regard to the epigastric and spermatic vessels is the same as that mentioned above.

* Mr. Lawrence (op. cit.) remarks: "When we consider the texture of the peritonæum, and the mode of its connection to the abdominal parietes, we cannot fancy the possibility of tearing the membrane by any attitude or motion." Cloquet and Scarpa have also expressed themselves to the effect, that the peritonæum suffers a gradual distension before the protruding bowel.

* A hernia may be truly congenital, and yet the intestine may not enter the tunica vaginalis. Thus, if the serous spermatic tube close only at the top of the testicle, the bowel which traverses the open internal inguinal ring and pervious tube will not enter the tunica vaginalis.

PLATE 20, Fig. 4. — If the serous spermatic tube, 11, be obliterated or closed at the internal ring, 1, thus cutting off communication with the general peritonæal membrane; and if, at the same time, it remain pervious from this point above to the tunica vaginalis below, then the herniary bowel, when about to protrude at the point 1, must force and dilate the peritonæum, in order to form its sac anew, as stated of Fig. 1, Plate 20. Such a hernia does not enter either the serous tube or the tunica vaginalis; but progresses from the point 1, in a distinct sac. In this case, there will be found two sacs, — one enclosing the bowel; and another, consisting of the serous spermatic tube, still continuous with the tunica vaginalis. This original state of the parts may, however, suffer modification in two modes: 1st, If the bowel rupture the peritonæum at the point 1, it will enter the serous tube, 11, and descend through this into the cavity of the tunica vaginalis, as in the congenital variety. 2d, If the bowel rupture the peritonæum near the point 1, and does not enter the serous tube, 11, nor the tunica vaginalis, then the bowel will be found devoid of a proper serous sac, while the serous tube and tunica vaginalis still exist in communication. In either case, the hernia will hold the same relative position in regard to the epigastric artery and spermatic vessels, as stated of Fig. 1, Plate 20.

PLATE 20, Fig. 5. — Sudden rupture of the peritonæum at the closed internal serous ring, 1, though certainly not impossible, may yet be stated as the exception to the rule in the formation of an external inguinal hernia. The aphorism, "natura non facit saltus," is here applicable. When the peritonæum suffers dilatation at the internal ring, 1, it advances *gradatim* and *pari passu* with the progress of the protruding bowel, and assumes the form, character, position, and dimensions of the inverted curved phases, marked 11, 11, till, from having at first been a very shallow pouch, lying external to the epigastric artery, 9, it advances through the inguinal canal to the external ring, 4, and ultimately traverses this aperture, taking the course of the fibrous tube, 3, down to the testicle in the scrotum.

PLATE 20, Fig. 6. — When the bowel dilates the peritonæum opposite the internal ring, and carries a production of this membrane before it as its sac, then the hernia will occupy the inguinal canal, and become invested by all those structures which form the canal. These structures are severally infundibuliform processes, so fashioned by the original descent of the testicle; and, therefore, as the bowel follows the track of the testicle, it becomes, of course, invested by the selfsame parts in the selfsame manner. Thus, as the infundibuliform fascia, 2, 3, contains the hernia and spermatic vessels, so does the cremaster muscle, extending from the lower margins of the internal oblique and transversalis, invest them also in an infundibuliform manner.*

PLATE 20, Fig. 7. — When an external inguinal hernia, 11, dilates and protrudes the peritonæum from the closed internal ring, 1, and descends the inguinal canal and fibrous tube, 3, 3, it imitates, in most respects, the original descent of the testicle. The difference between both descents attaches alone to the mode in which they become covered by the serous membrane; for the testicle passes through the internal ring *behind* the inguinal peritonæum, at the same time that it takes a duplicature of this membrane; whereas the bowel encounters this part of the peritonæum *from within*, and in this mode becomes invested by it on all sides. This figure also represents the form and relative position of a hernia, as occurring in Figs. 1 and 3, 5, and 6, Plate 20.

PLATE 20, Fig. 8. — When the serous spermatic tube only closes at the internal ring, as seen at 1, Fig 4, Plate 20, if a hernia afterwards pouch the peritonæum at this part, and enter the inguinal canal, we shall then have the form of hernia, Fig. 8, Plate 20, termed infantile. Two serous sacs will be here found, one within the cord, 13, and communicating with the tunica vaginalis; the other, 11, containing the bowel, and being received by inversion into the upper extremity of the first. Thus the infantile serous canal, 13, receives the hernial sac, 11. The inguinal canal and cord may become multicapsular, as in Fig. 8, from various causes, each capsule being a distinct serous membrane. First, independent of hernial formation, the original serous tube may become interruptedly obliterated, as in Plate 10, Fig. 5. Secondly, these sacs may persist

* Much difference of opinion prevails as to the true relation which the cord (and consequently the oblique hernia) bears to the lower margins of the oblique and transverse Muscles, and their cremasteric prolongation. Mr. Guthrie (Inguinal and Femoral Hernia) has shown that the fibres of the transversalis, as well as those of the internal oblique, are penetrated by the cord. Albinus, Haller, Cloquet, Camper, and Scarpa, record opinions from which it may be gathered that this disposition of the parts is (with some exceptions) general. Sir Astley Cooper describes the lower edge of the transversalis as curved all round the internal ring and cord. From my own observations, coupled with these, I am inclined to the belief that, instead of viewing these facts as isolated and meaningless particulars, we should now fuse them into the one idea expressed by the philosophic Carus, and adopted by Cloquet, that the cremaster is a production of the abdominal muscles, formed mechanically by the testicle, which in its descent dilates, penetrates, and elongates their fibres.

to adult age, and have a hernial sac added to their number, whatever this may be. Thirdly, the original serous tube, 13, Fig. 8, may persist, and after having received the hernial sac, 11, the bowel may have been reduced, leaving its sac behind it in the inguinal canal; the neck of this sac may have been obliterated by the pressure of a truss, a second hernia may protrude at the point 1, and this may be received into the first hernial sac in the same manner as the first was received into the original serous infantile tube. The possibility of these occurrences is self-evident, even if they were never as yet experienced.*

PLATE 20, Fig. 9.—The epigastric artery, 9, being covered by the fascia transversalis, can lend no support to the internal ring, 2 2, nor to the tube prolonged from it. The herniary bowel may, therefore, dilate the peritonæum immediately on the inner side of the artery, and enter the inguinal canal. In this way the hernia, 11, although situated internal to the epigastric artery, assumes an oblique course through the canal, and thus closely simulates the external variety of inguinal hernia, Fig. 7, Plate 20. If the hernia enter the canal, as represented in Fig. 9, Plate 40, it becomes invested by the same structures, and assumes the same position in respect to the spermatic vessels, as the external hernia.

PLATE 20, Fig. 10.—The hernial sac, 11, which entered the ring of the fibrous tube, 2 2, at a point immediately internal to the epigastric artery, 9, may, from having been at first oblique, as in Fig. 1, Plate 42, assume a direct position. In this case the ring of the fibrous tube, 2 2, will be much widened; but the artery and spermatic vessels will remain in their normal position, being in no wise affected by the gravitating hernia. If the conjoined tendon, 6, be so weak as not to resist the gravitating force of the hernia, the tendon will become bent upon itself. If the umbilical cord, 10, be side by side with the epigastric artery at the time that the hernia enters the mouth of the fibrous tube, then, of course, the cord will be found external. If the cord lie towards the pubes, apart from the vessel, the hernia may enter the fibrous tube between the cord, 10, and artery, 9.† It is impossible for any internal hernia to assume the congenital form, because the neck of the original serous spermatic tube, 11, Fig. 2, Plate 20, being external to the epigastric artery, 9, cannot be entered by the hernia, which originates internally to this vessel.

PLATE 20, Fig. 11.—Every internal hernia, which does not rupture the peritonæum, carries forward a sac produced anew from this membrane, whether the hernia enter the inguinal canal or not. But this is not the case with respect to the fibrous membrane which forms the fascia propria. If the hernia enter the inguinal wall immediately on the inner side of the epigastric artery, Fig. 9, Plate 20, it passes direct into the ring of the fibrous tube, 2 2, already prepared to receive it. But when the hernia, 11, Fig. 11, Plate 20, cleaves the conjoined tendon, 6 6, then the artery, 9, and the tube, 2 2, remain in their usual position, while the bowel carries forward a new investment from the transversalis fascia, 5 5. That part of the conjoined tendon which stands external to the hernia keeps the tube, 2 2, in its proper place, and separates it from the fold of the fascia which invests the hernial sac. This is the only form in which an internal hernia can be said to be absolutely distinct from the inguinal canal and spermatic vessels. This hernia, when passing the external ring, 4, has the spermatic cord on its outer side.

PLATE 20, Fig. 12.—The external hernia, from having been originally oblique, may assume the position of a hernia originally internal and direct. The change of place exhibited by this form of hernia does not imply a change either in its original investments or in its position with respect to the epigastric artery and spermatic vessels. The change is merely caused by the weight and gravitation of the hernial mass, which bends the epigastric artery, 9*, from its first position on the inner margin of the internal ring, 1, till it assumes the place, 9. In consequence of this, the internal ring of the fascia transversalis, 2 2, is considerably widened, as it is also in Fig. 10, Plate 20. It is the inner margin of the fibrous ring which has suffered the pressure; and thus the hernia now projects directly from behind forwards, through, 4, the external ring. The conjoined tendon, 6, when weak, becomes bent upon itself. The change of place performed by the gravitating hernia may disturb the order and relative position of the spermatic vessels; but these, as well as the hernia, still occupy the inguinal canal, and are invested by the spermatic fascia, 3 3. When an internal hernia, Fig. 9, Plate 20, enters the inguinal canal, it also may descend the cord as far as the testicle, and assume in respect to this gland the same position as the external hernia.*

* According to Mr. Lawrence and M. Cloquet, most of the serous cysts found around hernial tumours are ancient sacs obliterated at the neck, and adhering to the new swelling (opera cit.)

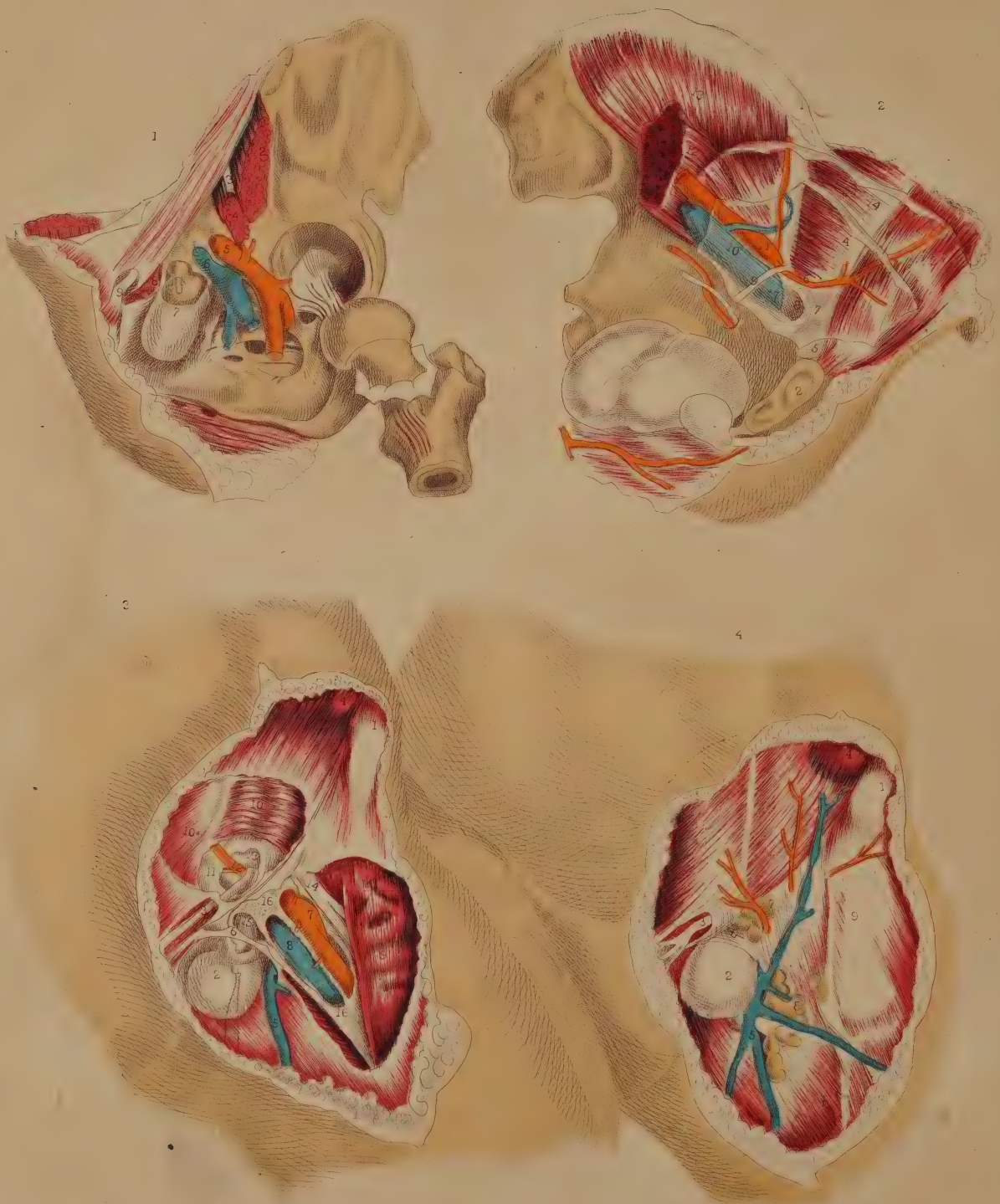
† M. Cloquet states that the umbilical cord is always found on the inner side of the external hernia. Its position varies in respect to the internal hernia, (op. cit. prop. 52.)

* As the external hernia, Fig. 4, Plate 42, may displace the epigastric artery inwards, so may the internal hernia, Fig. 1, Plate 42, displace the artery outwards. Mr. Lawrence, Sir Astley Cooper,

PLATE 20, Figs. 13, 14, 15. — The form and position of the inguinal canal varies according to the sex and age of the individual. In early life, Fig. 14, the internal ring is situated nearly opposite to the external ring, 4. As the pelvis widens gradually in the advance to adult age, Fig. 13, the canal becomes oblique as to position. This obliquity is caused by a change of place, performed rather by the internal than the external ring.* The greater width of the female pelvis than of the male, renders the canal more oblique in the former; and this, combined with the circumstance that the female inguinal canal, Fig. 15, merely transmits the round ligament, 14, accounts anatomically for the fact, that this sex is less liable to the occurrence of rupture in this situation.

Scarpa, Hesselbach, and Langenbeck, state, however, that the internal hernia does not disturb the artery from its usual position three-fourths of an inch from the external ring.

*M. Velpeau (Nouveaux Elemens de med. Operat.) states the length of the inguinal canal in a well-formed adult, measured from the internal to the external ring, to be 1 1-2 or 2 inches, and 3 inches including the rings; but that in some individuals the rings are placed nearly opposite; whilst in young subjects the two rings nearly always correspond. When, in company with these facts, we recollect how much the parts are liable to be disturbed in ruptures, it must be evident that their relative position cannot be exactly ascertained by measurement, from any given point whatever. The judgment alone must fix the general average.



DESCRIPTION OF PLATE 21.

Figure 1.

1. Anterior superior iliac spine.
2. Iliacus muscle, cut.
3. Anterior crural nerve, cut.
4. Psoas muscle, cut.
5. Femoral artery enclosed in *e*, its compartment of the femoral sheath.
6. Femoral vein in its compartment, *f*, of the femoral sheath.
7. The fascia propria of the hernia; *g*, the contained sac.
8. Gimbernat's ligament.
9. Round ligament of the uterus.

Figure 2.

1. Anterior superior iliac spine.
2. Symphysis pubis.
3. Rectus abdominis muscle.
4. Peritonæum.
5. Conjoined tendon.
6. Epigastric artery.
7, 7. Positions of the obturator artery when given off from the epigastric.
8. Neck of the sac of the crural hernia.
9. Round ligament of the uterus.
10. External iliac vein.
11. External iliac artery.
12. Tendon of the psoas parvus muscle, resting on the psoas magnus.
13. Iliacus muscle.
14. Transversalis fascia.

Figure 3.

1. Anterior superior iliac spine.
2. The crural hernia.
3. Round ligament of the uterus.
4. External oblique muscle; *d*, Fig. 2, its aponeurosis.
5. Saphæna vein.
6. Falciform process of the saphenous opening.
7. Femoral artery at its sheath.
8. Femoral vein in its sheath.
9. Sartorious muscle.
10. Internal oblique muscle; *k*, conjoined tendon.
11. Transversalis fascia.
12. Epigastric artery.
13. Peritonæum.
14. Anterior crural nerve.
15. The hernia within the crural canal.
16. Femoral sheath.
17. Gimbernat's ligament.

Figure 4.

The other letters refer to the same parts as seen in Fig. 3.

7. Glands in the neighborhood of Poupart's ligament.
8. Glands in the neighborhood of the saphenous opening.
9. The sartorious muscle seen through its fascia.

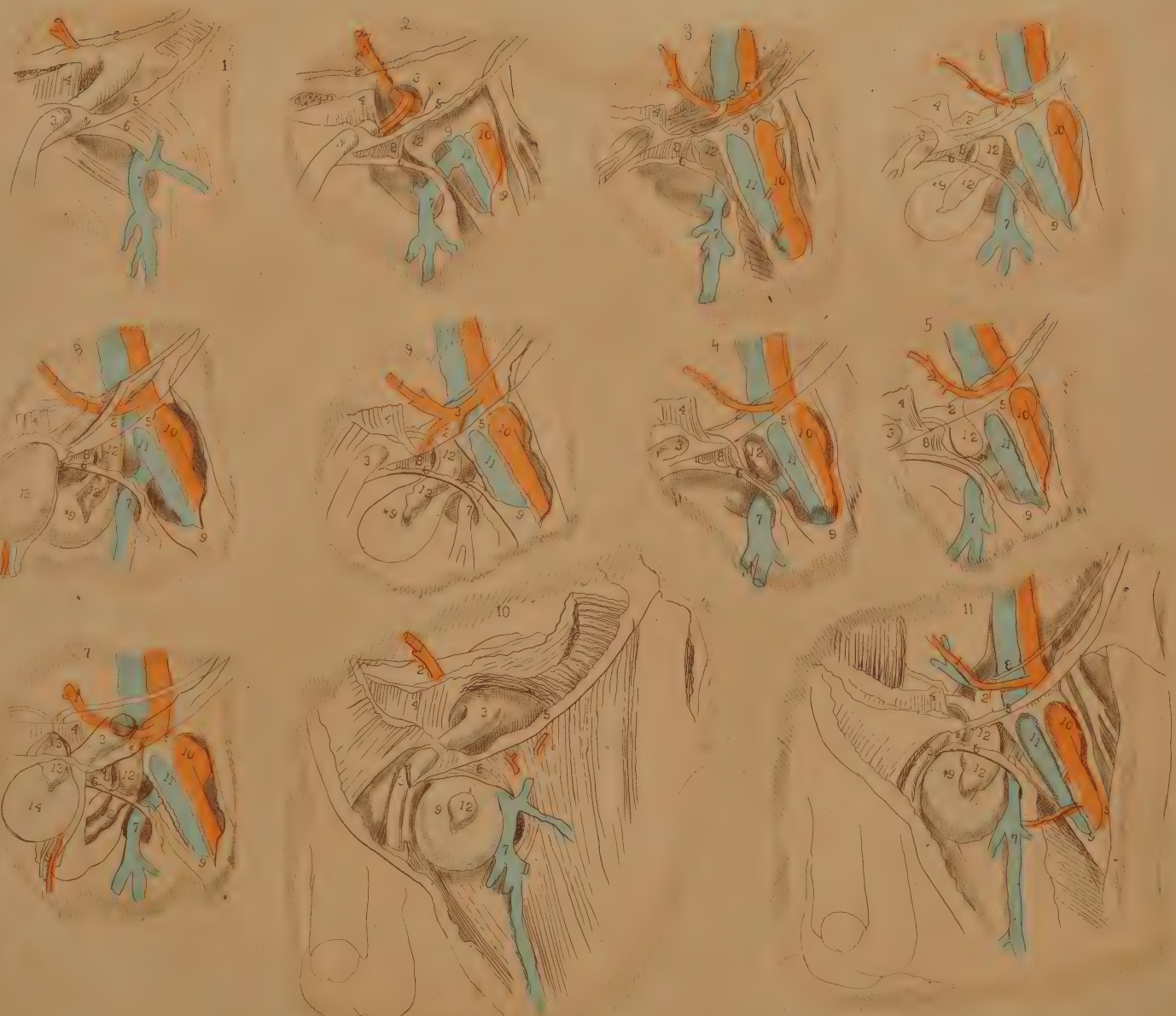


PLATE 22.

DEMONSTRATIONS OF THE ORIGIN AND PROGRESS OF FEMORAL HERNIA — ITS DIAGNOSIS, THE TAXIS, AND THE OPERATION.

PLATE 22, Fig. 1. — The point, 3, from which an external inguinal hernia first progresses, and the part, 5, within which the femoral hernia begins to be formed, are very close to each other. The inguinal hernia, 3, arising above, 5, the crural arch, descends the canal, 3 3, under cover of the aponeurosis of the external oblique muscle, obliquely downwards and inwards till it gains the external abdominal ring formed in the aponeurosis, and thence descends to the scrotum. The femoral hernia, commencing on a level with 5, the femoral arch, descends the femoral canal, under cover of the fascia lata, and appears on the upper and forepart of the thigh at the saphenous opening, 6 7, formed in the fascia lata; and thence, instead of descending to the scrotum, like the inguinal hernia, turns, on the contrary, up over the falciform process, 6, till its fundas rests near, 5, the very place beneath which it originated. Such are the peculiarities in the courses of these two herniæ; and they are readily accounted for by the anatomical relations of the parts concerned.

PLATE 22, Fig. 2. — There exists a very evident analogy between the canals through which both herniæ pass. The infundibuliform fascia, 3 3, of the spermatic vessels is like the infundibuliform sheath, 9 9, of the femoral vessels. Both sheaths are productions of the general fibrous membrane of the abdomen. They originate from nearly the same locality. The ring of the femoral canal, 12, is situated immediately below, but to the inner side of the internal inguinal ring, 3. The epigastric artery, 1, marks the width of the interval which separates the two rings. Poupart's ligamant, 5, being the line of union between the oblique aponeurosis of the abdominal muscle and the fascia lata, merely overarches the femoral sheath, and does not separate it absolutely from the spermatic sheath.

PLATE 22, Fig. 3. — The peritonæum, 2 3, closes the femoral canal, 12, at the femoral ring, in the same way as this membrane closes the inguinal canal at the internal inguinal ring, 3, Fig. 2, Plate 45. The epigastric artery always holds an intermediate position between both rings. The spermatic vessels in the inguinal tube, 3 3, Fig. 2, Plate 22, are represented by the round ligament in the female inguinal canal, Fig. 3, Plate 22. When the bowel is about to protrude at either of the rings, it first dilates the peritonæum, which covers these openings.

PLATE 22, Fig. 4. — The place of election for the formation of any hernia is that which is structurally the weakest. As the space which the femoral arch spans external to the vessels is fully occupied by the psoas and iliacus muscles, and, moreover, as the abdominal fibrous membrane and its prolongation, the femoral sheath, closely embrace the vessels on their outer anterior and posterior sides, whilst on their inner side the membrane and sheath are removed at a considerable interval from the vessels, it is through this interval (the canal) that the hernia may more readily pass. The peritonæum, 2, and crural septum, 13, form at this place the only barrier against the protrusion of the bowel into the canal.

PLATE 22, Fig. 5. — The hernia cannot freely enter the compartment, 10, occupied by the artery, neither can it enter the place 11, occupied as it is by the vein. It cannot readily pass through the inguinal wall at a point internal to, 9, the crural sheath, for here it is opposed by, 4, the conjoined tendon, and by, 8, Gimbernat's ligament. Neither will the hernia force a way at a point external to the femoral vessels in preference to that of the crural canal, which is already prepared to admit it.* The bowel, therefore, enters the femoral canal, 9, and herein it lies covered by its peritonæal sac, derived from that part of

* The mode in which the femoral sheath, continued from the abdominal membrane, becomes simply applied to the sides of the vessels, renders it of course not impossible for a hernia to protrude into the sheath at any point of its abdominal entrance. Mr. Stanley and M. Cloquet have observed a femoral hernia external to the vessels. Hesselbach has also met with this variety. A hernia of this nature has come under my own observation. Cloquet has seen the hernia descend the sheath *once* in front of the vessels, and *once* behind them. These varieties, however, must be very rare. The external form has never been met with by Hey, Cooper, or Scarpa; whilst no less than six instances of it have come under the notice of Mr. Macilwain, (on Hernia, p. 293).

the membrane which once masked the crural ring. The septum crurale itself, having been dilated before the sac, of course invests it also. The femoral canal forms now the third covering of the bowel. If in this stage of the hernia it should suffer constriction, Gimbernat's ligament, 8, is the cause of it. An incipient femoral hernia of the size of 2 12, cannot, in the undissected state of the parts, be detected by manual operation; for, being bound down by the dense fibrous structures which gird the canal, it forms no apparent tumor in the groin.

PLATE 22, Fig. 6.—The hernia, 2 12, increasing gradually in size, becomes tightly impacted in the crural canal, and being unable to dilate this tube uniformly to a size corresponding with its own volume, it at length bends towards the saphenous opening, 6 7, this being the more easy point of egress. Still, the neck of the sac, 2, remains constricted at the ring, whilst the part which occupies the canal is also very much narrowed. The fundus of the sac, 9* 12, alone expands, as being free of the canal; and covering this part of the hernia may be seen the fascia propria, 9*. This fascia is a production of the inner wall of the canal; and if we trace its sides, we shall find its lower part to be continuous with the femoral sheath, whilst its upper part is still continuous with the fascia transversalis. When the hernia ruptures the saphenous side of the canal, the fascia propria is, of course, absent.

PLATE 22, Fig. 7.—The anatomical circumstances which serve for the diagnosis of a femoral from an inguinal hernia may be best explained by viewing in contrast the respective positions assumed by both complaints. The direct hernia, 13, traverses the inguinal wall from behind, at a situation corresponding with the external ring; and from this latter point it descends the scrotum. An oblique external inguinal hernia enters the internal ring, 3, which exists farther apart from the general median line, and, in order to gain the external ring, has to take an oblique course from without inwards through the inguinal canal. A femoral hernia enters the crural ring, 2, immediately below, but on the inner side of, the internal inguinal ring, and descends the femoral canal, 12, vertically to where it emerges through, 6 7, the saphenous opening. The direct inguinal hernia, 13, owing to its form and position, can scarcely ever be mistaken for a femoral hernia. But in consequence of the close relationship between the internal inguinal ring, 3, and the femoral ring, 2, through which their respective herniæ pass, some difficulty in distinguishing between these complaints may occur. An incipient femoral hernia, occupying the crural canal between the points, 2, 12, presents no apparent tumor in the undissected state of the parts; and a bubonocele, or incipient inguinal hernia, occupying the inguinal canal, 3, 3, where it is braced down by the external oblique aponeurosis, will thereby be also obscured in some degree. But, in most instances, the bubonocele distends the inguinal canal somewhat; and the impulse which on coughing is felt at a place above the femoral arch, will serve to indicate, by negative evidence, that it is not a femoral hernia.

PLATE 22, Fig. 8.—When the inguinal and femoral herniæ are fully produced, they best explain their distinctive nature. The inguinal hernia, 13, descends the scrotum, whilst the femoral hernia, 9*, turns over the falciform process, 6, and rests upon the fascia lata and femoral arch. Though in this position the fundus of a femoral hernia lies in the neighborhood of the inguinal canal, 3, yet the swelling can scarcely be mistaken for an inguinal rupture, since, in addition to its being superficial to the aponeurosis which covers the inguinal canal, and also to the femoral arch, it may be withdrawn readily from this place, and its body, 12, traced to where it sinks into the saphenous opening, 6 7, on the upper part of the thigh. An inguinal hernia manifests its proper character more and more plainly as it advances from its point of origin to its termination in the scrotum. A femoral hernia, on the contrary, masks its proper nature, as well at its point of origin as at its termination. But when a femoral hernia stands midway between these two points — viz., in the saphenous opening, 6 7, it best exhibits its special character; for here it exists below the femoral arch, and considerably apart from the external abdominal ring.

PLATE 22, Fig. 9.—The neck of the sac of a femoral hernia, 2, lies always close to, 3, the epigastric artery. When the obturator artery is derived from the epigastric, if the former pass internal to the neck behind, 8, Gimbernat's ligament, it can scarcely escape being wounded when this structure is being severed by the operator's knife. If, on the other hand, the obturator artery descend external to the neck of the sac, the vessel will be comparatively remote from danger while the ligament is being divided. In addition to the fact that the cause of stricture is always on the pubic side, 8, of the neck of the sac, 12, thereby requiring the incision to correspond with this situation only, other circumstances, such as the constant presence of the femoral vein, 11, and the epigastric artery, 1, determine the avoidance of ever incising the canal on its outer or upper side. And if the obturator artery,* by rare oc-

*M. Velpeau (Médécine Operatoire), in reference to the relative frequency of cases in which the obturator artery is derived from the epigastric, remarks, "L'examen que j'ai pu en faire sur plusieurs

currence happen to loop round the inner side of the neck of the sac, supposing this to be the seat of stricture, what amount of anatomical knowledge, at the call of the most dexterous operator, can render the vessel safe from danger?

The taxis, in a case of crural hernia, should be conducted in accordance with anatomical principles. The fascia lata, Poupart's ligament, and the abdominal aponeurosis, are to be relaxed by bending the thigh inwards to the hypogastrium. By this measure, the falciform process, 6, is also relaxed; but I doubt whether the situation occupied by Gimbernat's ligament allows this part to be influenced by any position of the limb or abdomen. The hernia is then to be drawn from its place above Poupart's ligament, (if it have advanced so far,) and when brought opposite the saphenous opening, gentle pressure made outwards, upwards, and backwards, so as to slip it beneath the margin of the falciform process, will best serve for its reduction. When this cannot be effected by the taxis, and the stricture still remains, the cutting operation is required.

The precise seat of the stricture cannot be known except during the operation. But it is to be presumed that the sac and contained intestine suffer constriction throughout the whole length of the canal.* Previously to the commencement of the operation, the urinary bladder should be emptied; for this organ, in its distended state, rises above the level of the pubic bone, and may thus be endangered by the incision through the stricture — especially if Gimbernat's ligament be the structure which causes it.

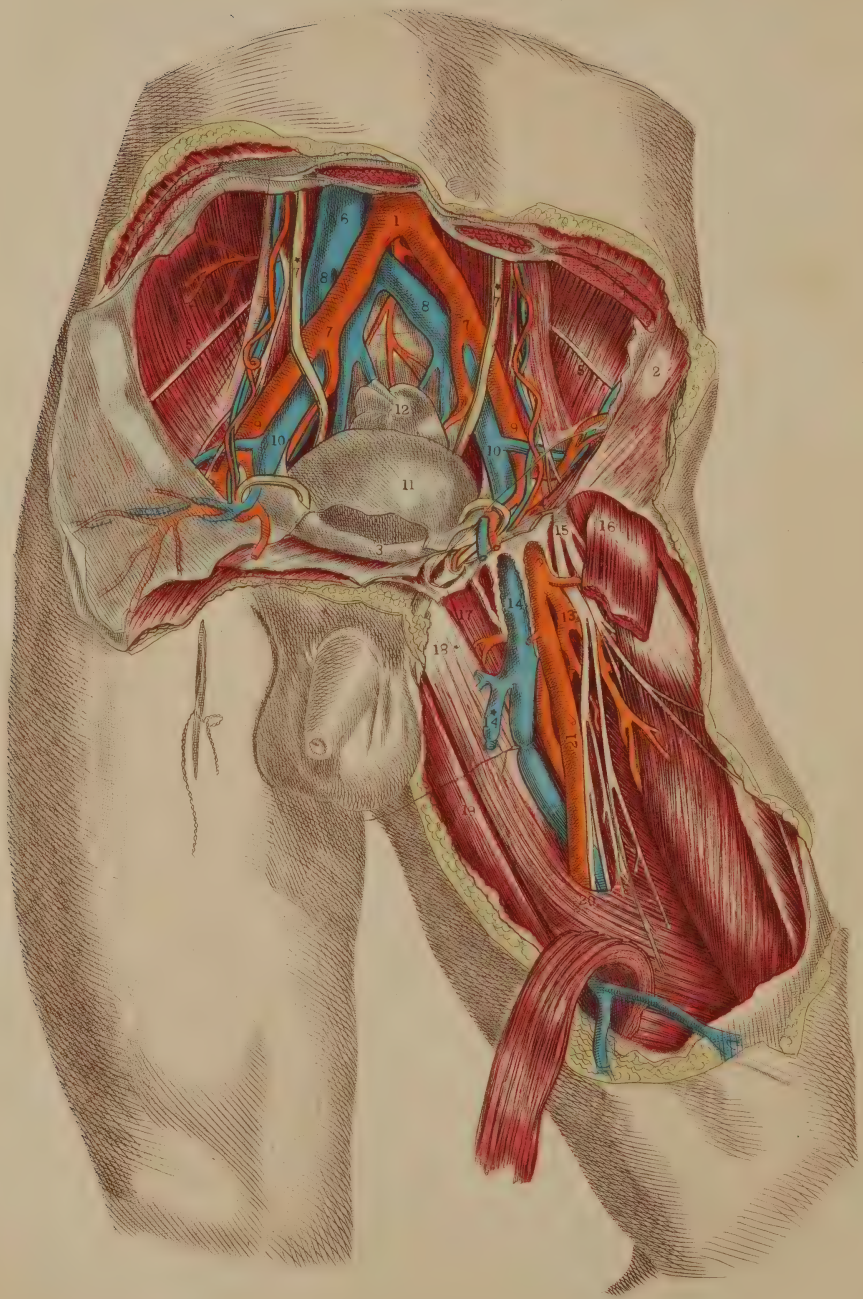
An incision commencing a little way above Poupart's ligament, is to be carried vertically over the hernia, parallel with, but to the inner side of its median line. This incision divides the skin and subcutaneous adipose membrane, which latter varies considerably in quantity in several individuals. One or two small arteries (superficial pubic, etc.) may be divided, and some lymphatic bodies exposed. On cautiously turning aside the incised adipose membrane contained between the two layers of the superficial fascia, the fascia propria, 9, Figs. 10, 11, Plate 22, of the hernia is exposed. This envelope, besides varying in thickness in two or more cases, may be absent altogether. The fascia closely invests the sac, 12; but sometimes a layer of fatty substance interposes between the two coverings, and resembles the omentum so much, that the operator may be led to doubt whether or not the sac has been already opened. The fascia is to be cautiously slit open on a director; and now the sac comes in view. The hernia having been drawn outwards, so as to separate it from the inner wall of the crural canal, a director* is next to be passed along the interval thus left, the groove of the instrument being turned to the pubic side. The position of the director is now between the neck of the sac and the inner wall of the canal. The extent to which the director passes up in the canal will vary according to the suspected level of the stricture. A probe-pointed bistoury is now to be slid along the director, and with its edge turned upwards and inwards, according to the seat of stricture, the following mentioned parts are to be divided — viz., the falciform process, 6; the inner wall of the canal, which is continuous with the fascia propria, 9; Gimbernat's ligament, 8; and the conjoined tendon, 4; where this is inserted with the ligament into the pectineal ridge. By this mode of incision, which seems to be all-sufficient for the liberation of the stricture external to the neck of the sac,

milliers de cadavres, ne me permet pas de dire qu'elle se rencontre un fois sur trois, ni sur cinq, ni même sur dix, mais bien seulement sur quinze á vingt." Monro (Obs. on Crural Hernia) states this condition of the obturator artery to be as 1 in 20-30. Mr. Quain (Anatomy of the Arteries) gives, as the result of his observations, the proportion to be as 1 in 3 1-2, and in this estimate he agrees to a great extent with the observations of Cloquet and Hesselbach. Numerical tables have also been drawn up to show the relative frequency in which the obturator descends on the outer and inner borders of the crural ring and neck of the sac. Sir A. Cooper never met with an example where the vessel passed on the inner side of the sac, and from this alone it may be inferred that such a position of the vessel is very rare. It is generally admitted that the obturator artery, when derived from the epigastric, passes down much more frequently between the iliac vein and outer border of the ring. The researches of anatomists (Monro and others) in reference to this point have given rise to the question, "What determines the position of the obturator artery with respect to the femoral ring?" It appears to me to be one of those questions which do not admit of a precise answer by any mode of mathematical computation; and even if it did, where then is the practical inference?

* "The seat of the stricture is not the same in all cases, though, in by far the greater number of instances, the constriction is relieved by the division upwards and inwards of the falciform process of the fascia lata, and the lunated edge of Gimbernat's ligament, where they join with each other. In some instances, it will be the fibres of the deep crescentic (femoral) arch; in others, again, the neck of the sac itself, and produced by a thickening and contraction of the subserous and peritonæal membranes where they lie within the circumference of the crural ring." — *Morton* (Surgical Anatomy of the Groin, p. 148).

† The finger is the safest director; for at the same time that it guides the knife it feels the stricture and protects the bowel. As all the structures which are liable to become the seat of stricture — viz., the falciform process, Gimbernat's ligament, and the conjoined tendon, lie in very close apposition, a very short incision made upwards and inwards is all that is required.

we avoid Poupart's ligament; and thereby the spermatic cord, 3, and epigastric artery, 1, are not endangered. The crural canal being thus laid open on its inner side, and the constricting fibrous bands being severed, the sac may now be gently manipulated, so as to restore it and its contents to the cavity of the abdomen; but if any impediment to the reduction still remain, the cause, in all probability, arises either from the neck of the sac having become strongly adherent to the crural ring, or from the bowel being bound by bands of false membrane to the sac. In either case, it will be necessary to open the sac, and examine its contents. The neck of the sac is then to be exposed by an incision carried through the integument across the upper end of the first incision, and parallel with Poupart's ligament. The neck is then to be divided on its inner side, and the exposed intestine may now be restored to the abdomen.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DESCRIPTION OF PLATE 23.

1. The aorta at its point of bifurcation.
2. The anterior superior iliac spine.
3. The symphysis pubis.
4. Poupart's ligament, immediately above which are seen the circumflex ilii and epigastric arteries, with the vas deferens and spermatic vessels.
5, 5. The right and left iliac muscles covered by the peritonæum; the external cutaneous nerve is seen through the membrane.
6. The vena cava.
7, 7. The common iliac arteries giving off the internal iliac branches on the sacro-iliac symphyses; 7*, 7*, the right and left ureters.
8, 8. The right and left common iliac veins.
9, 9. The right and left external iliac arteries, each is crossed by the circumflex ilii vein.
10, 10. The right and left external iliac veins.
11. The urinary bladder covered by the peritonæum.
12. The rectum intestinum.
13. The profundus branch of the femoral artery.
14. The femoral vein; 14*, the saphena vein.
15. The anterior crural nerve.
16. The sartorius muscle, cut.
17. The pectinæus muscle.
18. The adductor longus muscle.
19. The gracilis muscle.
20. The tendinous sheath given off from the long adductor muscle, crossing the vessels, and becoming adherent to the vastus internus muscle.
21. The femoral artery. The figure is on the part where the vessel becomes first covered by the sartorius muscle.

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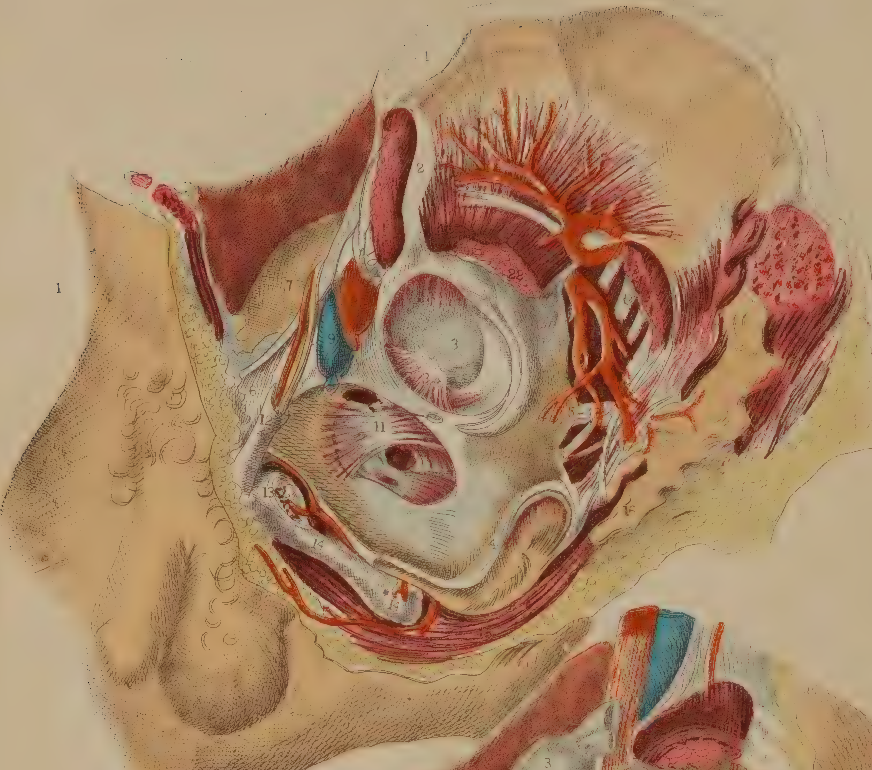

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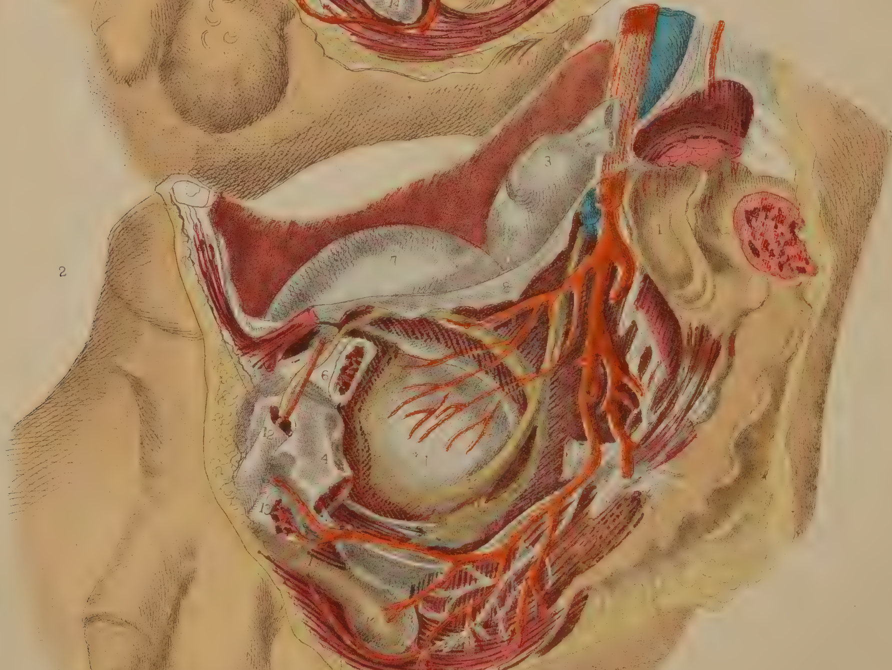


DESCRIPTION OF PLATE 24.

Figure 1.

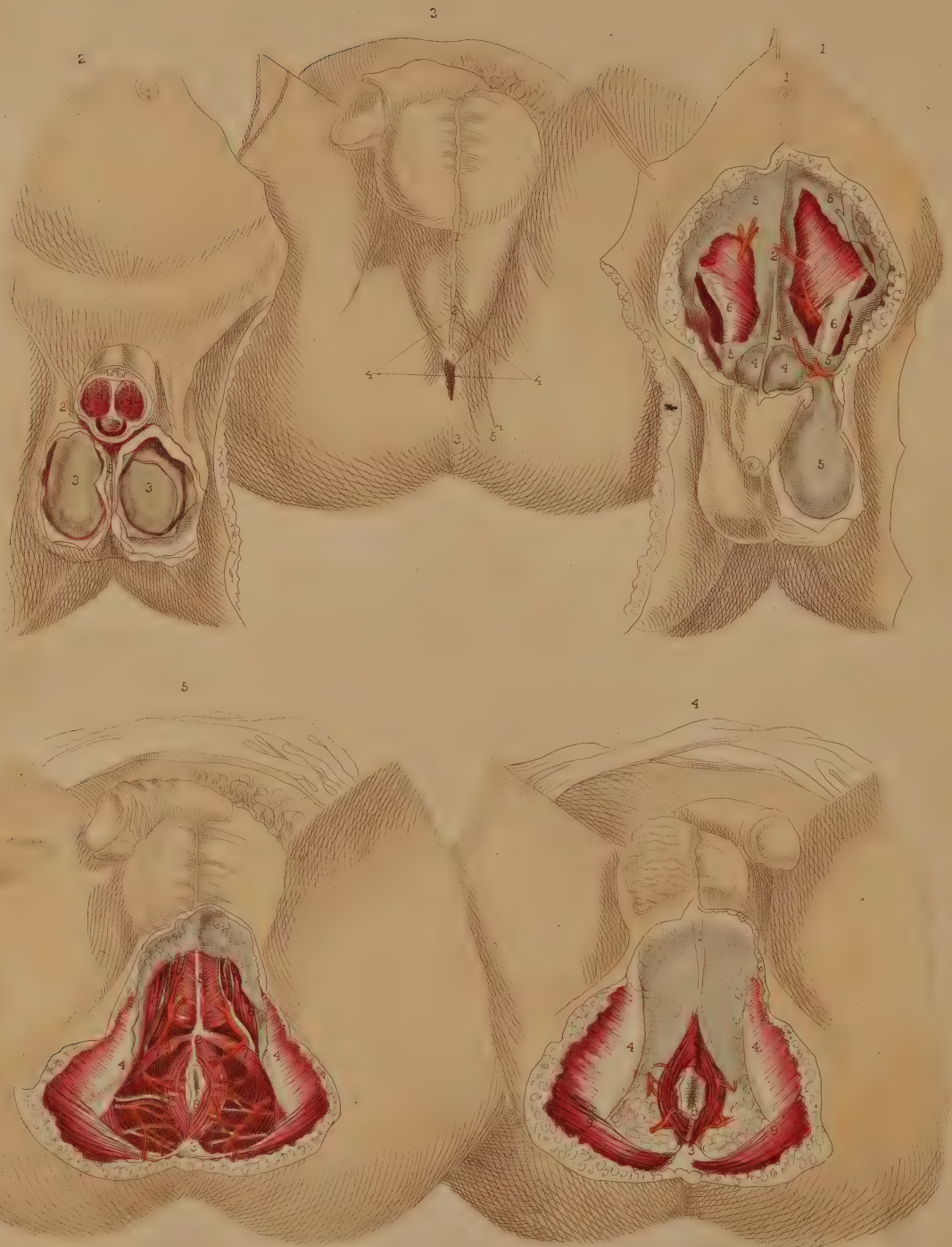
1. The anterior superior iliac spine.
2. The anterior inferior iliac spine.
3. The acetabulum; 3*, the ligamentum teres.
4. The tuber ischii.
5. The spine of the ischium.
6. The pubic horizontal ramus.
7. The summit of the bladder covered by the peritonæum.
8. The femoral artery.
9. The femoral vein.
10. The anterior crural nerve.
11. The thyroid ligament.
12. The spermatic cord.
13. The corpus cavernosum penis; and its artery.
14. The urethra; 14*, the bulbous urethræ.
15. The sphincter ani muscle.
16. The coccyx.
17. The sacro-sciatic ligament.
18. The pudic artery and nerve.
19. The sacral nerves.
20. The pyriformis muscle, cut.
21. The gluteal artery.
22. The small gluteus muscle.

Figure 2.

1. The part of the sacrum which joins the ilium.
2. The external iliac artery, cut across.
3. The upper part of the rectum.
4. The ascending pubic ramus.
5. The spine of the ischium cut.
6. The horizontal pubic ramus, cut.
7. The summit of the bladder covered by the peritonæum; 7*, its side, not covered by the membrane.
8. The recto-vesical peritonæal pouch.
9. The vas deferens.
10. The ureter.
11. The vesicula seminalis.

12, 13, 14, 15, 16, 17, 18, 19, 20, refer to the same parts as in Fig. 1.

21. The prostate.
22. The lower part of the rectum.
23. The deep perinæal fascia.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DESCRIPTION OF PLATE 25.

FIGURE 1.

1. The umbilicus.
2. The linea alba.
3. The suspensory ligament of the penis.
4. The two corpora cavernosa penis.
5. The hypogastric and scrotal superficial fascia.
6. The spermatic cords.

FIGURE 2.

1. The umbilicus.
3. The urethra.
4. The tunica vaginalis; 4, on the left side, the testicle invested by the tunic.
5. The corpora cavernosa seen in section.
6. The scrotal raphè and septum scroti.

FIGURE 3.

1, 2. The perinæal raphè.
3. The place of the coccyx.
4. The projections of the ischiatic tuberosities.
5, 6. The line of section in lithotomy.

FIGURE 4.

1. The superficial fascia covering the urethral space.
2. The sphincter ani.
3. The coccyx.
4. The right and left ischiatic tuberosities.
8. The anus.
9. The glutei muscles.

FIGURE 5.

1, 2, 3, 4, 5, 6. The same parts as in Fig. 4.
7. The accelerator urinæ muscle.
8. The anus.

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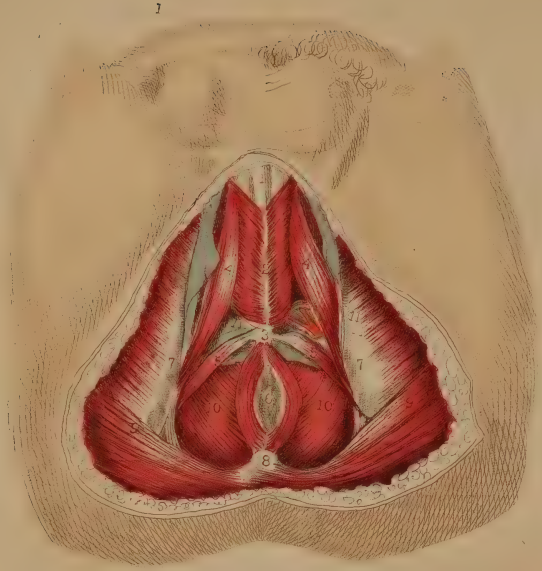

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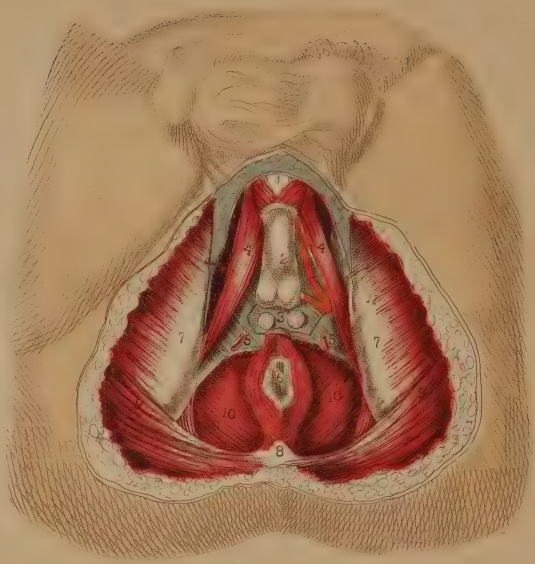

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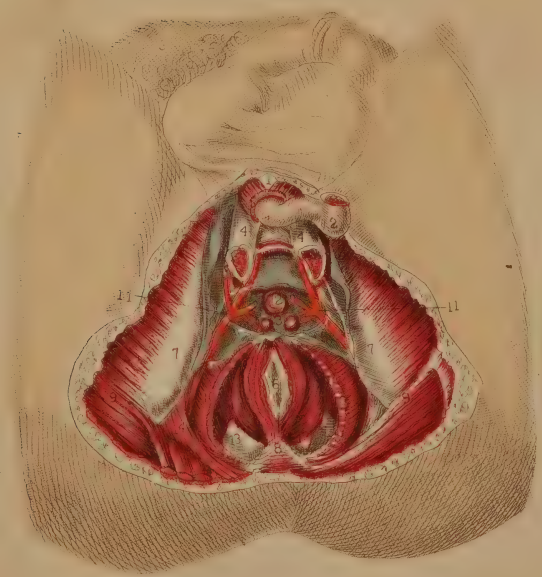

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DESCRIPTION OF PLATE 26.

FIGURE 1.

1. The urethra.
2. Accelerator urinæ muscle.
3. Central perinæal tendon.
4. Right and left erector penis muscle.
5. The transverse muscles.
6. The anus.
7. The ischiatic tuberosities.
8. The coccyx.
9. The glutei muscles.
10. The levator ani muscle.
11. The artery of the bulb.

FIGURE 2.

1, 4, 6, 7, 8, 9, 10, 11, refer to the same parts as in Fig. 1.

3. Cowper's glands between the two layers of—
5. The deep perinæal fascia.

FIGURE 3.

1, 2, 3, 5, 6, 7, 8, 9, 10, 11, refer to the same parts as in Fig. 2.

4. The two crura penis.
12. The urethra in section.
13. The rectum.
14. The sacro-sciatic ligament.

FIGURE 4.

1, 2, 4, 7, 8, 9, 10, 11, 14, refer to the same parts as in Fig. 3.

3. The two lobes of the prostate.
16. The rectum turned down.
12. The membranous part of the urethra.
13. The vesiculæ seminales.
15. The base of the bladder.
6. The two vasa deferentia.

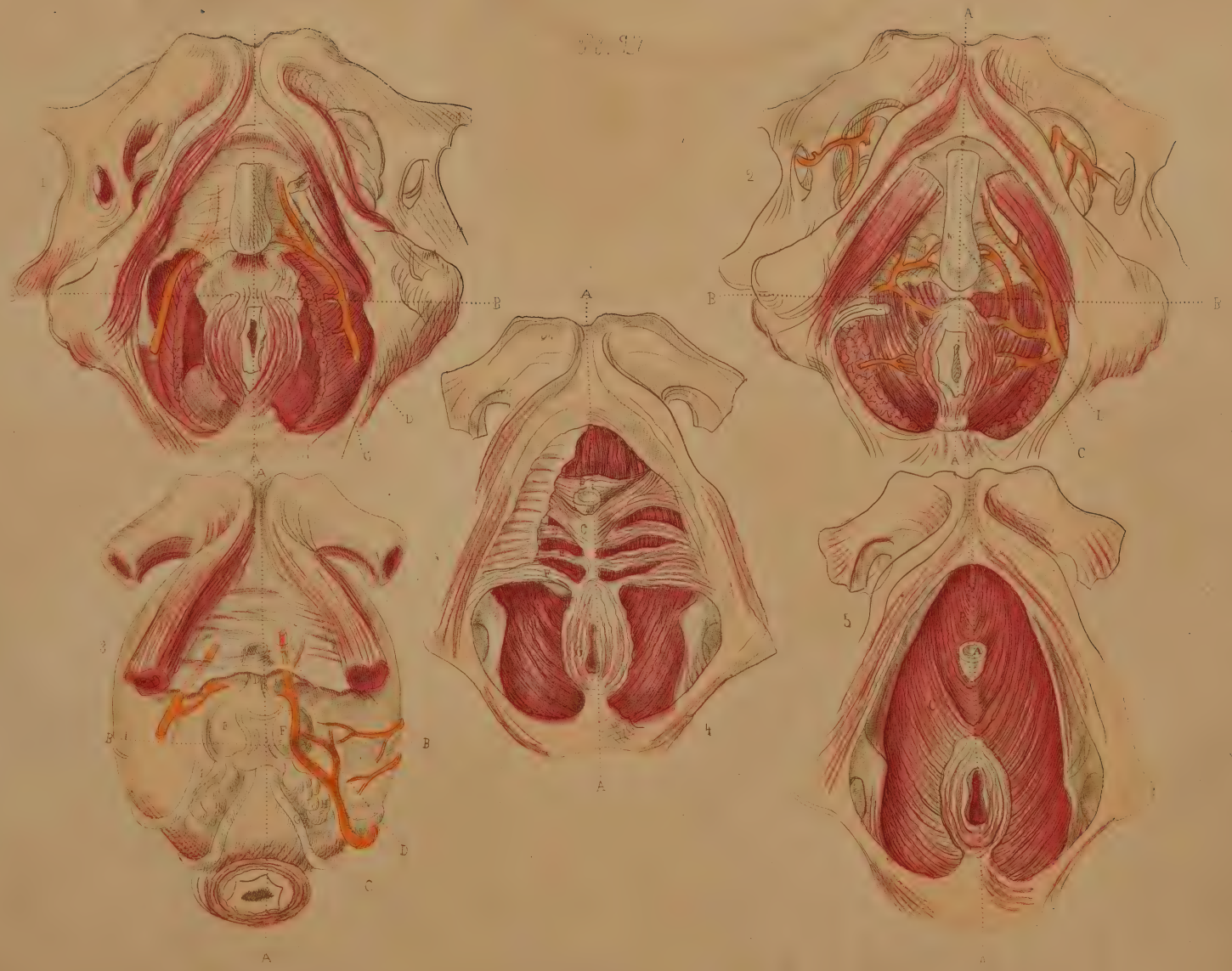

PLATE 27.

THE SURGICAL DISSECTION OF THE MALE BLADDER AND URETHRA.—LATERAL AND BILATERAL LITHOTOMY COMPARED.

Fig. 1 represents the normal relations of the more important parts concerned in lithotomy as performed at the perinæal region. The median line, A A, drawn from the symphysis pubis above, to the point of the coccyx below, is seen to traverse vertically the centres of the urethra, the prostate, the base of the bladder, the anus, and the rectum. These several parts are situated at different depths from the perinæal surface. The bulb of the urethra and the lower end of the bowel are on the same plane comparatively superficial. The prostate lies between these two parts, and on a plane deeper than they. The base of the bladder is still more deeply situated than the prostate; and hence it is that the end of the bowel is allowed to advance so near the pendent bulb, that those parts are in a great measure concealed by these. As the apex of the prostate lies an inch (more or less) deeper than the bulb, so the direction of the membranous urethra, which intervenes between the two, is according to the axis of the pelvic outlet; the prostatic end of the membranous urethra being deeper than the part near the bulb. The scalpel of the lithotomist, guided by the staff in this part of the urethra, is made to enter the neck of the bladder *deeply* in the same direction. On comparing the course of the pudic arteries with the median line, A A, we find that they are removed from it at a wider interval below than above; and also that where the vessels first enter the perinæal space, winding around the spines of the ischia, they are much deeper in this situation (on a level with the base of the bladder) than they are when arrived opposite the bulb of the urethra. The transverse line, B B, drawn in front of the anus from one tuber ischii to the other, is seen to divide the perinæum into the anterior and posterior spaces, and to intersect at right angles the median line A A. In the same way the line B B divides transversely both pudic arteries, the front of the bowel, the base of the prostate, and the sides of the neck of the bladder. Lateral lithotomy is performed in reference to the line A A; the bilateral operation in regard to the line B B. In order to avoid the bulb and rectum at the median line, and the pudic artery at the outer side of the perinæum, the lateral incisions are made obliquely in the direction of the lines C D. In the bilateral operation the incision necessary to avoid the bulb of the urethra in front, the rectum behind, and the pudic arteries laterally, is required to be made of a semicircular form, corresponding with the forepart of the bowel; the cornua of the incision being directed behind. In the lateral operation, the incision C through the integument, crosses at an acute angle the deeper incision D, which divides the neck of the bladder, the prostate, etc. The left lobe of the prostate is divided obliquely in the lateral operation; both lobes transversely in the bilateral.

Fig. 2.—If the artery of the bulb happens to arise from the pudic opposite the tuber ischii, or if the inferior hemorrhoidal arteries be larger than usual, these vessels crossing the lines of incision in both operations will be divided. If the superficial lateral incision C, Fig. 1, be made too deeply at its forepart, the artery of the bulb, even when in its usual place, will be wounded; and if the deep lateral incision D be carried too far outwards, the trunk of the pudic artery will be severed. These accidents are incidental in the bilateral operation, also, in performing which it should be remembered that the bulb is in some instances so large and pendulous as to lie in contact with the front of the rectum.

Fig. 3.—When the pudic artery crosses in contact with the prostate, F, it must inevitably be divided in either mode of operation. Judging from the shape of the prostate, I am of opinion that this part, whether incised transversely in the line B B, or laterally in the line D, will exhibit a wound in the neck of the bladder of equal dimensions. When the calculus is large, it is recommended to divide the neck of the bladder by an incision, combined of the transverse and the lateral. The advantages gained by such a combination are, that while the surface of the section made in the line D is increased by "notching" the right lobe of the prostate in the direction of the line B, the sides of both sections are thereby rendered more readily separable, so as to suit with the rounded form of the calculus to be extracted. These remarks are equally applicable as to the mode in which the superficial perinæal

incision should be made under the like necessity. If the prostate be *wholly* divided in either line of section, the pelvic fascia adhering to the base of this body will be equally subject to danger. By incising the prostate transversely, B B, the seminal ducts, G H, which enter the base of this body, are likewise divided; but by the simple lateral incision D being made through the forepart of the left lobe, F, these ducts will escape injury.* On the whole, therefore, the lateral operation appears preferable to the bilateral one.

Fig. 4. — The muscular structures surrounding the membranous urethra and the neck of the bladder, and which are divided in lithotomy, have been examined from time to time by anatomists with more than ordinary painstaking, owing to the circumstance that they are found occasionally to offer, by spasmodic contraction, an obstacle to the passage of the catheter along the urethral canal. These muscles do not appear to exist in all subjects alike. In some, they are altogether wanting; in others a few of them only appear; in others, they seem to be not naturally separable from the larger muscles which are always present. Hence it is that the opinions of anatomists respecting their form, character, and even their actual existence, are so conflicting, not only against each other, but against nature. In Fig. 4, I have summed together all the facts recorded concerning them,† and on comparing these facts with what I have myself observed, the muscles seem to me to assume originally the form and relative position of the parts B C D E F viewed in their totality. Each of these parts of muscular structure arises from the ischio-pubic ramus, and is inserted at the median line A A. They appear to me, therefore, to be muscles of the same category, which, if all were present, would assume the serial order of B C D E F. When one or more of them are omitted from the series, there occurs anatomical variety, which of course occasions variety in opinion, fruitless though never ending. By that interpretation of the parts which I here venture to offer, and to which I am guided by considerations of a higher law of formation, I encompass and bind together, as with a belt, all the dismembered parts of variety, and of these I construct a uniform whole. Forms become, when not viewed under comparison, as meaningless hieroglyphics as the algebraic symbols, $a+c-d=11$, are when the mind is devoid of the power of calculation.

Fig. 5. — The membranous urethra A is also in some instances embraced by two symmetrical fasciculi of muscular fibres B B, which, arising from the posterior and lower part of the symphysis pubis, descend on either side of the canal and join beneath it. The muscles B C, Fig. 4, are between the two layers of the deep perinæal fascia, while the muscle B B, Fig. 5, lies like the fore part of the levator ani, C C, behind this structure and between it and the anterior ligaments of the bladder.* As to the interpretation of the muscle, I myself am inclined to believe that it is simply a part of the levator ani, and for these reasons: 1st, it arises from the pubic symphysis, and is inserted into the perinæal median line with the levator ani; 2nd, the fibres of both muscles overlie the forepart of the prostate, and present the same arrangement in parallel order; 3rd, the one is not naturally separable from the other.

*As to the mode in which the superficial and deep incisions in lateral lithotomy should be made, a very eminent operating surgeon remarks: "A free incision of the skin I consider a most important feature in the operation; but beyond this the application of the knife should, in my opinion, be extremely limited. In so far as I can perceive, there should be no hesitation in cutting any part of the gland which seems to offer resistance, with the exception, perhaps, of its under surface, where the position of the seminal ducts, and other circumstances, should deter the surgeon from using a cutting instrument." — Wm. Fergusson, *Practical Surgery*, 3d Am. Ed., p. 610.

† The part C is that alone described by Santorini, who named it "elevator urethræ," as passing beneath the urethra. The part B is that first observed and described by Mr. Guthrie as passing above the urethra. The part F represents the well-known "transversalis perinæi," between which and the part C there occasionally appears the part E, supposed to be the "transversalis alter" of Albinus, and also the part D, which is the "ischio bulbosus" of Cruveilhier. It is possible that I may not have given one or other of these parts its proper name, but this will not affect their anatomy.

* This is the muscle, B B, which is described by Santorini as the "levator prostatæ;" by Winslow as "le prostatique superieur;" by Wilson as the "pubo-urethrales;" by Muller as not existing; by Mr. Guthrie as forming (when existing), with the parts B C, Fig. 2, Plate 55, his "compressor isthmi urethræ;" and by M. Cruveilhier as being *part of the levator ani muscle.* "As in one case," (observes Mr. Quain,) "I myself saw a few vertical muscular fibres connected with the transverse compressor, it has been thought best to retain the muscle in the text." — Dr. Quain's *Anat.*, Am. Ed., vol. II., p. 539.

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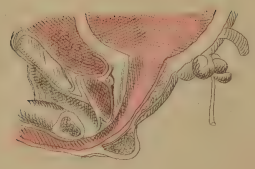

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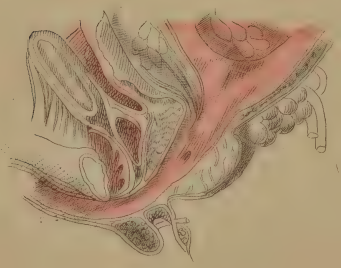

PLATE 28.

Fig. 1 represents by section the natural forms of the urethra and bladder. The general direction of the urethra, measured during its relaxed state from the vesical orifice to the glans, is usually described as having the form of the letter S laid procumbent to the right side ᔕ or to the left ᔓ. But as the anterior half of the canal is moveable, and liable thereby to obliterate the general form, while the posterior half is fixed, I shall direct attention to the latter half chiefly, since upon its peculiar form and relative position depends most of the difficulty in the performance of catheterism. The portion of the urethra which intervenes between the neck of the bladder, 10, and the point 5, where the penis is suspended from the front of the symphysis pubis by the suspensory ligament, assumes very nearly the form of a semicircle, whose anterior half looks toward the forepart, and whose posterior half is turned to the back of the pubis. The pubic arch, 1, spans crossways the middle of this part of the urethra, 2, opposite the bulb, 8. The two extremes, 6 10, of this curve, and the lower part of the symphysis pubis, occupy in the adult the same antero-posterior level; and it follows, therefore, that the distance to which the urethra near its bulb, 8, is removed from the pubic symphysis above, must equal the depth of its own curve, which measures about an inch perpendicularly. The urethral aperture of the triangular ligament appears removed at this distance below the pubic symphysis, and that portion of the canal which lies behind the ligament, and ascends obliquely backwards and upwards to the vesical orifice on a level with the symphysis pubis in the adult, should be remembered as varying both in direction and length in individuals of the extremes of age. In the young, this variation is owing to the usual high position of the bladder in the pelvis, whilst in the old it may be caused by an enlarged state of the prostate. The curve of the urethra now described is permanent in all positions of the body, while that portion of the canal anterior to the point 6, which is free, relaxed, and moveable, can by traction towards the umbilicus be made to continue in the direction of the fixed curve, 6 10, and this is the general form which the urethra assumes when a bent catheter of ordinary shape is passed along the canal into the bladder. The length of the urethra varies at different ages and in different individuals, and its structure in the relaxed state is so very dilatable that it is not possible to estimate the width of its canal with fixed accuracy. As a general rule, the urethra is much more dilatable, and capable consequently of receiving an instrument of much larger bore in the aged than in the adult.

The three portions into which the urethra is described as being divisible, are the spongy, the membranous, and the prostatic. These names indicate the difference in the structure of each part. The spongy portion is the longest of the three, and extending from the glans to the bulb may be said on a rough, but for practical purposes a sufficiently accurate, estimate, to comprise seven parts of the whole urethra, which measures nine. The membranous and prostatic portions measure respectively one part of the whole. These relative proportions of the three parts are maintained in different individuals of the same age, and in the same individual at different ages. The spongy part occupies the inferior groove formed between the two united corpora cavernosa of the penis, and is subcutaneous as far back as the scrotum under the pubes, between which point and the bulb it becomes embraced by the accelerator urinæ muscle. The bulb and glans are expansions or enlargements of the spongy texture, and do not affect the calibre of the canal. When the spongy texture becomes injected with blood, the canal is rendered much narrower than otherwise. The canal of the urethra is uniform-cylindrical. The meatus is the narrowest part of it, and the prostatic part is the widest. At the point of junction between the membranous and spongy portions behind the bulb, the canal is described as being naturally constricted. Behind the meatus exists a dilatation (fossa navicularis), and opposite the bulb another (sinus of the bulb). Muscular fibres are said to enter into the structure of the urethra; but, whether such be the case or not, it is at least very certain that they never prove an obstacle to the passage of instruments, or form the variety of stricture known as spasmodic. The urethra is lined by a delicate mucous membrane presenting longitudinal folds, which become obliterated by distention; and its entire surface is numerously studded with the orifices of mucous cells (lacunæ), one of which, larger than the rest, appears on the upper side of the canal near the meatus. Some of these lacunæ are nearly an inch long, and all of them open in an oblique

direction forwards. Instruments having very narrow apices are liable to enter these ducts and to make false passages. The ducts of Cowper's glands open by very minute orifices on the sides of the spongy urethra anterior to and near the bulb. On the floor of the prostatic urethra appears the crest of the veru montanum, upon which the two seminal ducts open by orifices directed forwards. On either side of the veru montanum the floor of the prostate may be seen perforated by the "excretory ducts" of this so-called *gland*. The part K, which is here represented as projecting from the floor of the bladder, near its neck, is named the "uvula vesicæ," (Lieutaud.) It is the same as that which is named the "third lobe of the prostate," (Home.) The part does not appear as proper to the bladder in the healthy condition, Fig. 2, Plate 28. On either side of the point 10 may be seen the orifices, 12 12*, of the ureters, opening upon two ridges of fibrous substance directed towards the uvula. These are the fibres which have been named by Sir Charles Bell as "the muscles of the ureters;" but, as they do not appear in the bladder when in a state of health, I do not believe that nature ever intended them to perform the function assigned to them by this anatomist. And the same may be said of the fibres, which, surrounding the vesical orifice, are supposed to act as the "sphincter vesicæ." The form of that portion of the base of the bladder which is named "trigone vesical" constitutes an equilateral triangle, and may be described by two lines drawn from the vesical orifice to both openings of the ureters, and another line reaching transversely between the latter. Behind the trigone a depression called "bas fond" is formed in the base of the bladder. Fig. 2 represents the prostate of a boy nine years of age. Fig. 3 represents that of a man aged forty years. A difference as to form and size, etc., is observable between both.

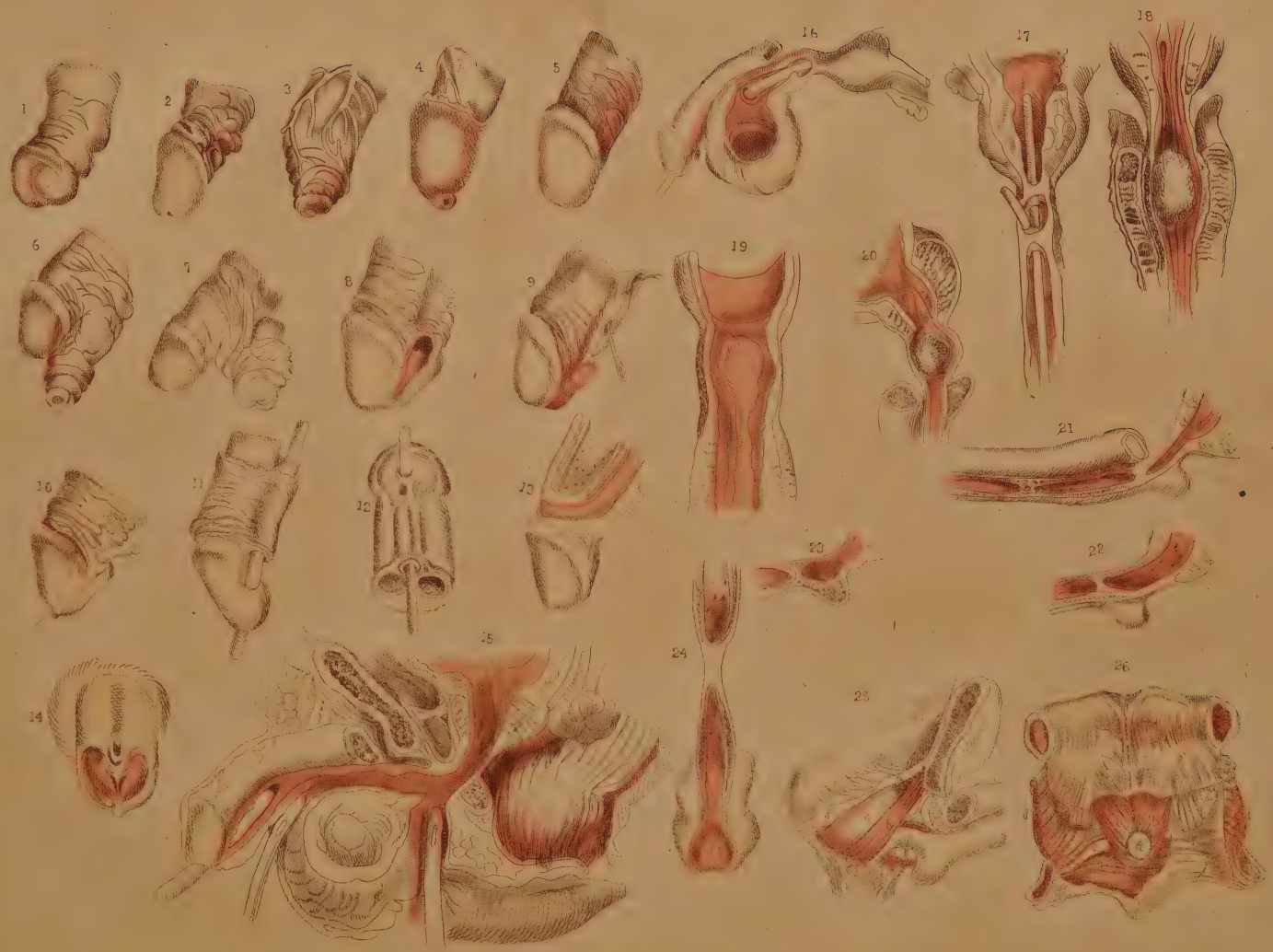
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PLATE 29.

CONGENITAL AND PATHOLOGICAL DEFORMITIES OF THE PREPUCE AND URETHRA. STRICTURE AND MECHANICAL OBSTRUCTIONS OF THE URETHRA.

When any of the central organs of the body presents in a form differing from that which we term natural, or structurally perfect and efficient, if the deformity be one which results as a malformation, ascribable to an error in the law of development, it is always characterized as an excess or defect of the substance of the organ at, and in reference to, the median line. And when any of the canals which naturally open upon the external surface at the median line happens to deviate from its proper position, such deviation, if it be the result of an error in the law of development, always occurs, by an actual necessity, at the median line. On the contrary, though deformities which are the results of diseased action in a central organ may and do, in some instances, simulate those which occur by an error in the process of development, the former cannot bear a like interpretation with the latter, for those are the effects of ever-varying circumstances, whereas these are the effects of certain deviations in a natural process, — a law, whose course is serial, gradational, and in the sequent order of a continuous chain of cause and effect.

Fig. 1 represents the prepuce in a state of congenital phymosis. The part hypertrophied and pendent projects nearly an inch in front of the meatus, and forms a canal, continued forwards from this orifice. As the prepuce in such a state becomes devoid of its proper function, and hence must be regarded, not only as a mere superfluity, but as a cause of impediment to the generative function of the whole organ, it should be removed by an operation.

Fig. 2 represents the prepuce in the condition of paraphymosis following gonorrhœal inflammation. The part appears constricting the penis and urethra behind the corona glandis. This state of the organ is produced in the following-mentioned way: the prepuce, naturally very extensible, becomes, while covering the glans, inflamed, thickened, and its orifice contracted. It is during this state withdrawn forcibly backwards over the glans, and in this situation, while being itself the first cause of constriction, it induces another, — namely, an arrest to the venous circulation, which is followed by a turgescence of the glans. In the treatment of such a case, the indication is, first, to reduce by gradual pressure the size of the glans, so that the prepuce may be replaced over it; secondly, to lessen the inflammation by the ordinary means.

Fig. 3 exhibits the form of a gonorrhœal phymosis. The orifice of the prepuce is contracted, and the tissue of it infiltrated. If in this state of the part, consequent upon diseased action, or in that of Fig. 1, which is congenital, the foreskin be retracted over the glans, a paraphymosis, like Fig. 2, will be produced.

Fig. 4 shows a form of phymosis in which the prepuce during inflammation has become adherent to the whole surface of the glans. The orifice of the prepuce being directly opposite the meatus, and the parts offering no obstruction to the flow of urine, an operation for separating the prepuce from the glans would not be required.

Fig. 5. — In this figure is represented the form of the penis of an adult, in whom the prepuce was removed by circumcision at an early age. The membrane covering the glans, and the part which is cicatrized, becomes in these cases dry, indurated, and deprived of its special sense.

Fig. 6. — In this figure the glans appears protruding through the upper surface of the prepuce, which is thickened and corrugated. This state of the parts was caused by a venereal ulceration of the upper part of the prepuce, sufficient to allow the glans to press through the aperture. The prepuce in this condition being superfluous, and acting as an impediment, should be removed by operation.

Fig. 7. — In this figure is shown a condition of the glans and prepuce resembling that last mentioned, and the effect of a similar cause. By the removal of the prepuce when in the position here represented, or in that of Fig. 6, the organ may be made to assume the appearance of Fig. 5.

Fig. 8 represents the form of a congenital hypospadias. The corpus spongiosum does not continue the canal of the urethra as far forwards as the usual position of the meatus, but has become defective behind the frænum præputii, leaving the canal open at this place. In a case of this kind, an operation on the taliacotian principle might be

tried in order to close the urethra where it presents abnormally patent.

Fig. 9 represents a congenital hypospadias, in which the canal of the urethra opens by two distinct apertures along the under surface of the corpus spongiosum at the middle line. A probe traverses both apertures. In such a case, if the canal of the urethra were perforate as far forwards as the meatus, and this latter in its normal position, the two false openings should be closed by an operation.

Fig. 10. — The urethra is here represented as having a false opening on its under surface behind the frænum. The perforation was caused by a venereal ulcer. The meatus and urethra anterior to the false aperture remained perforate. Part of a bougie appears traversing the false opening and the meatus. In this state of the organ an attempt should be made to close the false aperture permanently.

Fig. 11 shows a state of the urethra similar to that of Fig. 10, and the effect of the same cause. Part of a bougie is seen traversing the false aperture from the meatus before to the urethra behind. In this case, as the whole substance of the corpus spongiosum was destroyed for half an inch in extent, the taliacotian operation, by which lost quantity is supplied, is the measure most likely to succeed in closing the canal.

Fig. 12. — Behind the meatus, and on the right of the frænum, is represented a perforation in the urethra, caused by a venereal ulcer. The meatus and the false opening have approached by the contraction of the cicatrix; in consequence of which, also, the apex of the glans is distorted towards the urethra; a bougie introduced by the meatus occupies the urethral canal.

Fig. 13. — In this figure the canal of the urethra appears turning upwards and opening at the median line behind the corona glandis. This state of the urethra was caused by a venereal ulcer penetrating the canal from the dorsum of the penis. The proper direction of the canal might be restored by obliterating the false passage, provided the urethra remained perforate in the direction of the meatus.

Fig. 14 exhibits the form of a congenital epispadias, in which the urethra is seen to open on the dorsal surface of the prepuce at the median line. The glans appears cleft and deformed. The meatus is deficient at its usual place. The prepuce at the dorsum is in part deficient, and bound to the glans around the abnormal orifice.

Fig. 15 represents in section a state of the parts in which the urethra opened externally by one fistulous aperture behind the scrotum, and by another in front of the scrotum. At the latter place the canal beneath the penis became imperforate for an inch in extent. Parts of catheters are seen to enter the urethra through the fistulous openings; and another instrument is seen to pass by the proper meatus into the urethra as far as the point where this portion of the canal fails to communicate with the other. The under part of the scrotum presents a cleft corresponding with the situation of the scrotal septum. This state of the urinary passage may be the effect either of congenital deficiency or of disease. When caused by disease, the chief features in its history, taking these in the order of their occurrence, are: 1st, a stricture in the anterior part of the urethra; 2ndly, a rupture of this canal behind the stricture; 3rdly, the formation (on an abscess opening externally) of a fistulous communication between the canal and the surface of some part of the perinæum; 4thly, the habitual escape of the urine by the false aperture; 5thly, the obliteration of the canal to a greater or less extent anterior to the stricture; 6thly, the parts situated near the urethral fistula become so consolidated and confused that it is difficult in some and impossible in many cases to find the situation of the urethra, either by external examination or by means of the catheter passed into the canal. The original seat of the stricture becomes so masked by the surrounding disease, and the stricture itself, even if found by any chance, is generally of so impassable a kind, that it must be confessed there are few operations in surgery more irksome to a looker-on than is the fruitless effort made, in such a state of the parts, by a hand without a guide, to pass perforce a blunt pointed instrument like a catheter into the bladder. In some instances the stricture is slightly pervious, the urine passing in small quantity by the meatus. In others, the stricture is rendered wholly imperforate, and the canal either contracted or nearly obliterated anteriorly through disuse. Of these two conditions, the first is that in which catheterism may be tried with any reasonable hope of passing the instrument into the bladder. In the latter state, catheterism is useless, and the only means whereby the urethra may be rendered pervious in the proper direction is that of incising the stricture from the perinæum, and after passing a catheter across the divided part into the bladder, to retain the instrument in this situation till the wound and the fistulæ heal and close under the treatment proper for this end. (Mr. Syme.)

Fig. 16. — In this figure the urethra appears communicating with a sac like a scrotum. A bougie is represented entering by the meatus, traversing the upper part of the

sac, and passing into the membranous part of the urethra beyond. This case, which was owing to a congenital malformation of the urethra, exhibits a dilatation of the canal such as might be produced behind a stricture wherever situated. The urine, impelled forcibly by the whole action of the abdominal muscles against the obstructing part, dilates the urethra behind the stricture, and by a repetition of such force the part gradually yields more and more, till it attains a very large size, and protrudes at the perinæum as a distinct fluctuating tumor, every time that an effort is made to void the bladder. If the stricture in such a case happens to cause a complete retention of urine, and that a catheter cannot be passed into the bladder, the tumor should be punctured prior to taking measures for the removal of the stricture. (Sir B. Brodie.)

Fig. 17 represents two close strictures of the urethra, one of which is situated at the bulb, and the other at the adjoining membranous part. These are the two situations in which strictures of the organic kind are said most frequently to occur, (Hunter, Home, Cooper, Brodie, Phillips, Velpeau.) False passages likewise are mentioned as more liable to be made in these places than elsewhere in the urethral canal. These occurrences — the disease and the accident — would seem to follow each other closely, like cause and consequence. The frequency with which false passages occur in this situation appears to me to be chiefly owing to the anatomical fact, that the urethra at and close to the bulb is the most dependent part of the curve, 8 10, Fig. 1, Plate 28; and hence, that instruments descending to this part from before push forcibly against the urethra, and are more apt to protrude through it than to have their points turned so as to ascend the curve towards the neck of the bladder. If it be also true that strictures happen here more frequently than elsewhere, this circumstance will of course favor the accident. An additional cause why the catheter happens to be frequently arrested at this situation and to perforate the canal, is owing to the fact, that the triangular ligament is liable to oppose it, the urethral opening in this structure not happening to coincide with the direction of the point of the instrument. In the figure, part of a bougie traverses the urethra through both strictures and lodges upon the enlarged prostate. Another instrument, after entering the first stricture, occupies a false passage which was made in the canal between the two constricted parts.

Fig. 18. — A calculus is here represented lodging in the urethra at the bulb. The walls of the urethra around the calculus appear thickened. Behind the obstructing body the canal has become dilated, and, in front of it, contracted. In some instances the calculus presents a perforation through its centre, by which the urine escapes. In others, the urine makes its exit between the calculus and the side of the urethra, which it dilates. In this latter way the foreign body becomes loosened in the canal and gradually pushed forwards as far as the meatus, within which, owing to the narrowness of this aperture, it lodges permanently. If the calculus forms a complete obstruction to the passage of the urine, and its removal cannot be effected by other means, an incision should be made to effect this object.

Fig. 19 represents the neck of the bladder and neighboring part of the urethra of an ox, in which a polypous growth is seen attached by a long pedicle to the veru montanum and blocking up the neck of the bladder. Small irregular tubercles of organized lymph, and tumors formed by the lacunæ distended by their own secretion, their orifices being closed by inflammation, are also found to obstruct the urethral canal.

Fig. 20. — In this figure is represented a small calculus impacted in and dilating the membranous part of the urethra.

Fig. 21. — Two strictures are here shown to exist in the urethra, one of which is situated immediately in front of the bulb, and the other at a point midway between the bulb and the meatus.

Fig. 22. — A stricture is here shown situated at the bulb.

Fig. 23 represents a stricture of the canal in front of the bulb.

Fig. 24 represents the form of an old callous stricture half an inch long, situated midway between the bulb and the meatus. This is perhaps the most common site in which a stricture of this kind is found to exist. In some instances of old neglected cases, the corpus spongiosum appears converted into a thick gristly cartilaginous mass, *several inches in extent*, the passage here being very much contracted, and chiefly so at the middle of the stricture. When it becomes impossible to dilate or pass the canal of such a stricture by the ordinary means, it is recommended to divide the part by the lancetted stilette. (Stafford.) Division of the stricture, by any means, is no doubt the readiest and most effectual measure that can be adopted, provided we know clearly that the cutting instrument engages fairly the part to be divided. But this is a knowledge less likely to be attained if the stricture be situated behind than in front of the triangular ligament.

Fig. 25 exhibits a lateral view of the muscular parts which surround the membranous portion of the urethra

and the prostate; *a*, the membranous urethra embraced by the compressor urethræ muscle; *b*, the levator prostatæ muscle; *c*, the prostate; *d*, the anterior ligament of the bladder.

Fig. 26. — A posterior view of the parts seen in Fig. 25: *a*, the urethra divided in front of the prostate; *b b*, the levator prostatæ muscle; *c c*, the compressor urethræ; *d d*, parts of the obturator muscles; *e e*, the anterior fibres of the levator ani muscle; *f g*, the triangular ligament inclosing between its layers the artery of the bulb, Cowper's glands, the membranous urethra, and the muscular parts surrounding this portion of the canal. The fact that the flow of urine through the urethra happens occasionally to be *suddenly* arrested, and this circumstance contrasted with the opposite fact that the organic stricture is of *slow formation*, originated the idea that the former occurrence arose from a spasmodic muscular contraction. By many, this spasm was *supposed* to be due to the urethra being itself muscular. By others, it was *demonstrated* as being dependent upon the muscles which surround the membranous part of the urethra, and which act upon this part and constrict it. From my own observations I have formed the settled opinion that the urethra itself is not muscular. And though, on the one hand, I believe that this canal, *per se*, never causes by active contraction the spasmodic form of stricture, I am far from supposing, on the other, that *all* sudden arrests to the passage of urine through the urethra are solely attributable to spasm of the muscles which embrace this canal.

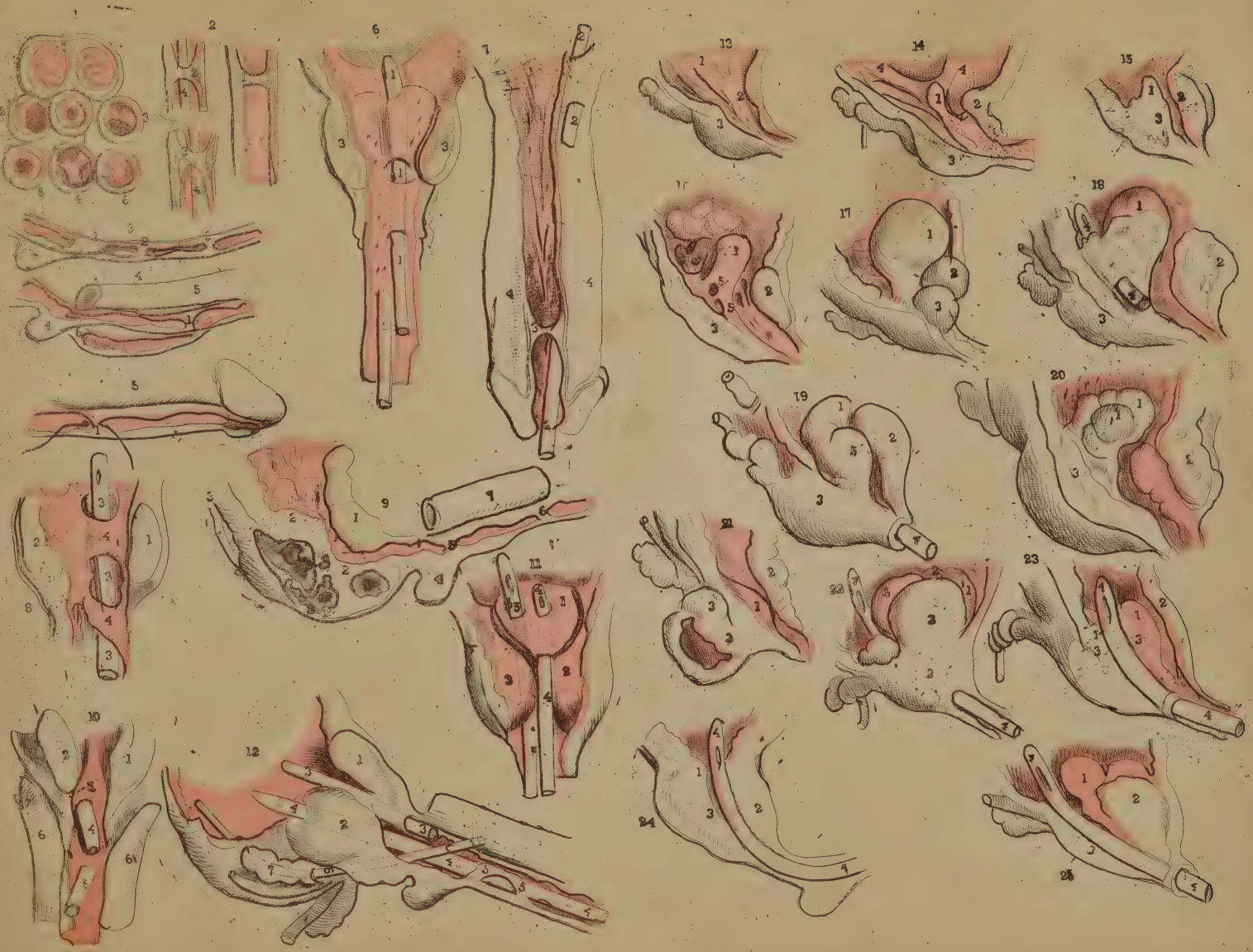


PLATE 30.

THE VARIOUS FORMS AND POSITIONS OF STRICTURES AND OTHER OBSTRUCTIONS OF THE URETHRA. — FALSE PASSAGES. — ENLARGEMENTS AND DEFORMITIES OF THE PROSTATE.

Impediments to the passage of the urine through the urethra may arise from different causes, such as the impaction of a small calculus in the canal, or any morbid growth (a polypus, etc.) being situated therein, or from an abscess which, though forming externally to the urethra may press upon this tube so as either to obstruct it partially, by bending one of its sides towards the other, or completely, by surrounding the canal on all sides. These causes of obstruction may happen in any part of the urethra, but there are two others (the prostatic and the spasmodic) which are, owing to anatomical circumstances, necessarily confined to the posterior two-thirds of the urethra. The portion of the urethra surrounded by the prostate can alone be obstructed by this body when it has become irregularly enlarged, while the spasmodic stricture can only happen to the membranous portion of the urethra, and to an inch or two of the canal anterior to the bulb, these being the parts which are embraced by muscular structures. The urethra itself, not being muscular, cannot give rise to the spasmodic form of stricture. But that kind of obstruction which is common to all parts of the urethra, and which is dependent, as well upon the structures of which the canal is uniformly composed, as upon the circumstance that inflammation may attack these in any situation and produce the same effect, is the permanent or organic stricture. Of this disease the forms are as various as the situations are, for as certainly as it may reasonably be supposed that the plastic lymph, effused in an inflamed state of the urethra from any cause, does not give rise to stricture of any special or particular form, exclusive of all others; so as certainly may it be inferred that, in a structurally uniform canal, inflammation points to no one particular place of it, whereat by preference to establish the organic stricture. The membranous part of the canal is, however, mentioned as being the situation most prone to the disease; but I have little doubt, nevertheless, that owing to general rules of this kind being taken for granted, upon imposing authority, many more serious evils (false passages, etc.) have been effected by catheterism than existed previous to the performance of this operation.*

Figs. 1 and 2. — In these figures are presented seven forms of organic stricture occurring in different parts of the urethra. In 1, Fig. 1, the mucous membrane is thrown into a sharp circular fold, in the centre of which the canal appears much contracted; a section of this stricture appears in 2, Fig. 2. In 2, Fig. 1, the canal is contracted laterally by a prominent fold of the mucous membrane at the opposite side. In 3, Fig. 1, an organized band of lymph is stretched across the canal; this stricture is seen in section 3, Fig. 2. In 5, Fig. 1, a stellate band of organized lymph, attached by pedicles to three sides of the urethra, divides the canal into three passages. In 4, Fig. 1, the canal is seen to be much contracted towards the left side by a crescentic fold of the lining membrane projecting from the right. In 6, the canal appears contracted by a circular membrane, perfo-

* Home describes "a natural constriction of the urethra, directly behind the bulb, which is probably formed with a power of contraction to prevent," etc. This is the part which he says is "most liable to the disease of stricture." (*Strictures of the Urethra.*) Now, if any one, even among the acute observing microscopists, can discern the structure to which Home alludes, he will certainly prove this anatomist to be a marked exception amongst those who, for the enforcement of any doctrine, can see any thing or phenomenon they wish to see. And, if Hunter were as the mirror from which Home's mind was reflected, then the observation must be imputed to the Great Original. Upon the question, however, as to which is the most frequent seat of stricture, I find that both these anatomists do not agree, Hunter stating that its usual seat is just in front of the bulb, while Home regrets, as it were, to be obliged to differ from "his immortal friend," and avers its seat to be an infinitesimal degree behind the bulb. Sir A. Cooper again, though arguing that the most usual situation of stricture is that mentioned by Hunter, names, as next in order of frequency, strictures of the membranous and prostatic parts of the urethra. Does it not appear strange, now, how questions of this import should have occupied so much of the serious attention of our great predecessors, and of those, too, who at the present time form the vanguard of the ranks of science? Upon what circumstance, either anatomical or pathological, can one part of the urethra be more liable to the organic stricture than another?

rated in the centre; a section of which is seen at 1, Fig. 2. The form of the organic stricture varies therefore according to the three following circumstances: 1st, When lymph becomes effused within the canal upon the surface of the lining mucous membrane, and contracts adhesions across the canal. 2ndly, When lymph is effused external to the lining membrane, and projects this inwards, thereby narrowing the diameter of the canal. 3rdly, When the outer and inner walls of a part of the urethra are involved in the effused organizable matter, and, on contracting towards each other, encroach at the same time upon the area of the canal. This latter state presents the form, which is known as the old callous tough stricture, extending in many instances for an inch or more along the canal. In cases where the urethra becomes obstructed by tough bands of substance, 25, which cross the canal directly, the points of flexible catheters, especially if these be of slender shape, are apt to be bent upon the resisting part, and, on pressure being continued, the operator may be led to suppose that the instrument traverses the stricture, while it is most probably perforating the wall of the urethra. But in those cases where the diameter of the canal is circularly contracted, the stricture generally presents a conical depression in front, which, receiving the point of the instrument, allows this to enter the central passage unerringly. A stricture formed by a crescentric septum, such as is seen in 24, Fig. 1, offers a more effectual obstacle to the passage of a catheter than the circular septum like 1, 8.

Fig. 3. — In this there are seen three separate strictures, 1, 2, 3, situated in the urethra, anterior to the bulb. In some cases there are many more strictures (even to the number of six or seven) situated in various parts of the urethra; and it is observed that when one stricture exists, other slight tightnesses in different parts of the canal frequently attend it. (Hunter.) When several strictures occur in various parts of the urethra, they may occasion as much difficulty in passing an instrument as if the whole canal between the extreme constrictions were uniformly narrowed.

Fig. 4. — In this the canal is constricted at the point 1, midway between the bulb and glans. A false passage has been made under the urethra by an instrument which passed out of the canal at the point 6, anterior to the stricture, 1, and re-entered the canal at the point, 3, anterior to the bulb. When a false passage of this kind happens to be made, it will become a permanent outlet for the urine, so long as the stricture remains. For it can be of no avail that we avoid re-opening the anterior perforation by the catheter, so long as the urine prevented from flowing by the natural canal enters the posterior perforation. Measures should be at once taken to remove the stricture.

Fig. 5. — The stricture, 1, appears midway between the bulb and glans, the area of the passage through the stricture being sufficient only to admit a bristle to pass. It would seem almost impossible to pass a catheter through a stricture so close as this, unless by a laceration of the part, combined with dilatation.

Fig. 6. — Two instruments, 1, 2, have made false passages beneath the mucous membrane, in a case where no stricture at all existed, — the resistance which the instruments encountered in passing out of the canal having been mistaken, no doubt, for that of passing through a close stricture.

Fig. 7. — A bougie, 2 2, is seen to perforate the urethra anterior to the stricture, 3, situated an inch behind the glans, and after traversing the substance of the right corpus cavernosum, 4, for its whole length, re-enters the neck of the bladder through the body of the prostate.

Fig. 8. — A bougie, 3 3, appears tearing and passing beneath the lining membrane, 4 4, of the prostatic urethra. It is remarked that the origin of a false passage is in general anterior to the stricture. It may, however, occur at any part of the canal in which no stricture exists, if the hand that impels the instrument be not guided by a true knowledge of the form of the urethra; and perhaps the accident happening from this cause is the more general rule of the two.

Fig. 9. — Two strictures are represented here, the one, 5, close to the bulb, 4; the other, 6, an inch anterior to this part. In the prostate, 1 2, are seen irregularly shaped abscess pits, communicating with each other, and projecting upwards the floor of this body to such a degree that the prostatic canal appears nearly obliterated.

Fig. 10. — Two bougies, 4, 5, are seen to enter the upper wall of the urethra, *c*, anterior to the prostate, 1, 2. This accident happens when the handle of a rigid instrument is depressed too soon, with the object of raising its point over the enlarged third lobe of the prostate.

Fig. 11. — Two instruments appear transfixing the prostate, of which body the three lobes, 1 2 3, are much enlarged. The instrument, 4, perforates the third lobe, 1, while the instrument, 5, penetrates the right lobe, 3, and the third lobe, 1. This accident occurs when instruments not possessing the proper prostatic bend are forcibly pushed forwards against the resistance at the neck of the bladder.

Fig. 12. — In this case an instrument, 4 4, after passing beneath part of the lining membrane, *e e*, anterior to

the bulb, penetrates, 2, the right lobe of the prostate. A second instrument, 3 3, penetrates the left lobe. A third smaller instrument, 6 6, is seen to pass out of the urethra anterior to the prostate, and, after transfixing the right vesicula seminalis external to the neck of the bladder, enters this viscus at a point behind the prostate. The resistance which the two larger instruments met with in penetrating the prostate made it seem, perhaps, that a tight stricture existed in this situation, to match which the smaller instrument, 6 6, was afterwards passed in the course marked out.

Figs. 13 to 17, represent a series of prostates, in which the third lobe gradually increases in size. In Fig. 13, which shows the healthy state of the neck of the bladder, unmarked by the prominent lines which are said to bound the space named "trigone vesical," or by those which indicate the position of the "muscles of the ureters," the third lobe does not exist. In Fig. 16 it appears as the uvula vesicæ, 1. In Fig. 15 the part 1 is increased, and under the name now of third lobe is seen to contract and bend upwards the prostatic canal. In Fig. 16 the effect which the growth of the lobe, 1, produces upon the form of the neck of the bladder becomes more marked, and the part presenting perforations, 5 5, produced by instruments, indicates that by its shape it became an obstacle to the egress of the urine as well as to the entrance of instruments. A calculus of irregular form is seen to lodge behind the third lobe, and to be out of reach of the point of a sound, supposing this to enter the bladder over the apex of the lobe. In Fig. 17 the three lobes are enlarged, but the third is most so, and, while standing on a narrow pedicle attached to the floor of the prostate, completely blocks up the neck of the bladder.*

Fig. 18. — The prostatic canal is bent upwards by the enlarged third lobe to such a degree as to form a right angle with the membranous part of the canal. A bougie is seen to perforate the third lobe, and this is the most frequent mode in which, under such circumstances, and with instruments of the usual imperfect form, access may be gained to the bladder for the relief of retention of urine. "The new passage may in every respect be as efficient as one formed by puncture or incision in any other way." (Fergusson.)

Fig. 19. — The three lobes of the prostate, 8, 2, 5, are equally enlarged. The prostatic canal is consequently much contracted and distorted, so that an instrument on being passed into the bladder has made a false passage through the third lobe. When a catheter is suspected to have entered the bladder by perforating the prostate, the instrument should be retained in the newly made passage till such time as this has assumed the cylindrical form of the instrument. If this be done, the new passage will be the more likely to become permanent. It is ascertained that all false passages and fistulæ by which the urine escapes, become after a time lined with a membrane similar to that of the urethra. (Stafford.)

Fig. 20. — The three lobes, 1, 2, 3, of the prostate are irregularly enlarged. The third lobe, 1 1, projecting from below, distorts the prostatic canal upwards and to the right side.

Fig. 21. — The right lobe, 1, 2, 3, of the prostate appears hollowed out so as to form the sac of an abscess which, by its projection behind, pressed upon the fore part of the rectum, and by its projection in front, contracted the area of the prostatic canal, and thereby caused an obstruction in this part. Not unfrequently, when a catheter is passed along the urethra, for the relief of a retention of urine caused by the swell of an abscess in this situation, the sac becomes penetrated by the instrument, and, instead of urine, pus flows. The sac of a prostatic abscess frequently opens of its own accord into the neighboring part of the urethra, and when this occurs it becomes necessary to retain a catheter in the neck of the bladder, so as to prevent the urine entering the sac.

Fig. 22. — The prostate presents four lobes of equal size, and all projecting largely around the neck of the bladder. The prostatic canal is almost completely obstructed, and an instrument has made a false passage through the lobe, 1.

Fig. 23. — The third lobe of the prostate is viewed in section, and shows the track of the false passage made by the catheter, 4, through it, from its apex to its base. The proper canal is bent upwards from its usual position, which is that at present marked by the instrument in the false passage.

Fig. 24. — The prostatic lobes are uniformly enlarged, and cause the corresponding part of the urethra to be uniformly contracted, so as closely to embrace the catheter, 6, 6, occupying it, and to offer considerable resistance to the passage of the instrument.

* On comparing this series of figures, it must appear that the third lobe of the prostate is the product of diseased action, in so far at least as an unnatural hypertrophy of a part may be so designated. It is not proper to the bladder in the healthy state of this organ, and where it does manifest itself by increase it performs no healthy function in the economy. When Home, therefore, described this part as a new fact in anatomy, he had in reality as little reason for so doing as he would have had in naming any other tumor, a thing unknown to normal anatomy. Langenbeck [Neue Bibl. b. i. p. 360] denies its existence in the healthy state. Cruveilhier [Anat. Pathog. liv. xxvii.] deems it incorrect to reckon a third lobe as proper to the healthy bladder.

Fig. 25. — The prostate, 2 3, is considerably enlarged anteriorly, 2, in consequence of which the prostatic canal appears more horizontal even than natural. The catheter, 4, occupying the canal, lies nearly straight. The lower wall, 3, of the prostate is much diminished in thickness. A nipple-shaped process, 1, is seen to be attached by a pedicle to the back of the upper part, 2, of the prostate, and to act like a stopper to the neck of the bladder. The body, 1, being moveable, it will be perceived how, while the bladder is distended with urine, the pressure from above may block up the neck of the organ with this part, and thus cause complete retention, which, on the introduction of a catheter, becomes readily relieved by the instrument pushing the obstructing body aside.

PLATE 31.

DEFORMITIES OF THE PROSTATE. — DISTORTIONS AND OBSTRUCTIONS OF THE PROSTATIC URETHRA.

The prostate is liable to such frequent and varied deformities, the consequence of diseased action, whilst, at the same time, its healthy function (if it have any) in the male body is unknown, that it admits at least of one interpretation which may, according to fact, be given of it, — namely, that of playing a principal part in effecting some of the most distressing of "the thousand natural ills that flesh is heir to." But, heedless of such a singular explanation of a final cause, the practical surgeon will readily confess the fitting application of the interpretation, such as it is, and rest contented with the proximate facts and proofs. As physiologists, however, it behooves us to look further into nature, and search for the *ultimate fact* in her prime moving law. The prostate is peculiar to the male body, the uterus to the female. With the exception of these two organs, there is not another which appears in the one sex but has its analogue in the opposite sex; and thus these two organs, the prostate and the uterus, appear by exclusion of the rest to approach the test of comparison, by which their analogy becomes as fully manifested as that between the two quantities, $a - b$, and $a + b$, the only difference which exists depends upon the subtraction or the addition of the quantity, b. The difference between a prostate and a uterus is simply one of quantity, such as we see existing between the male and the female breast. The prostate is to the uterus absolutely what a rudimentary organ is to its fully developed analogue. The one, as being superfluous, is, in accordance with nature's law of *nihil supervacaneum nihil frustra*, arrested in its development, and in such a character appears the prostate. This body *is not a gland* any more than is the uterus, but both organs being quantitatively, and hence functionally, different, I here once more venture to call down an interpretation of the part from the unfrequented bourne of comparative anatomy, and, turning it to lend an interest to the accompanying figures even with a surgical bearing, I remark that the prostatic or rudimentary uterus, like a germ not wholly blighted, is prone to an occasional sprouting or increase beyond its prescribed dimensions — a hypertrophy in barren imitation, as it were, of gestation.*

Fig. 1. — The prostate, 1 2, is here represented thinned in its walls above and below. The lower wall is dilated

* This expression of the fact to which I allude will not, I trust, be extended beyond the limits I assign to it. Though I have every reason to believe, that between the prostate of the male and the uterus of the female, the same amount of analogy exists as between a coccygeal ossicle and the complete vertebral form elsewhere situated in the spinal series, I am as far from regarding the two former to be in all respects structurally or functionally alike, as I am from entertaining the like idea in respect to the two latter. But still I maintain that between a prostate and a uterus, as between a coccygeal bone and a vertebra, the only difference which exists is one of quantity, and that hence arises the functional difference. A prostate is part of a uterus, just as a coccygeal bone is part (the centrum) of a vertebra. That this is the absolute signification of the prostate I firmly believe, and, were this the proper place, I could prove it in detail, by the infallible rule of analogical reasoning. John Hunter has observed that the use of the prostate was not sufficiently known to enable us to form a judgment of the bad consequences of its diseased state. When the part becomes morbidly enlarged, it acts as a mechanical impediment to the passage of urine from the bladder, but from this circumstance we cannot reasonably infer, that while of its normal healthy proportions, its special function is to facilitate the egress of the urine, for the female bladder, though wholly devoid of the prostate, performs its own function perfectly. It appears to me, therefore, that the real question should be, not what is the use of the prostate? but has it any proper function? If the former question puzzled even the philosophy of Hunter, it was because the latter question must be answered in the negative. The prostate has no function proper to itself *per se*. It is a thing distinct from the urinary apparatus, and distinct likewise from the generative organs. It may be hypertrophied, or atrophied, or changed in texture, or wholly destroyed by abscess, and yet neither of the functions of these two systems of organs will be impaired, if the part while diseased act not as an obstruction to them. In texture the prostate is similar to an unimpregnated uterus. In form it is, like the uterus, symmetrical. In position it corresponds to the uterus. The prostate has no ducts proper to itself. Those ducts which are said to belong to it (prostatic ducts) are merely mucous cells, similar to those in other parts of the urethral lining membrane. The seminal ducts evidently do not belong to it. The texture of the prostate is not such as appears in glandular bodies generally. In short, the facts which prove what it is not, prove what it actually is, — namely, a uterus arrested in its development, and as a sign of that all-encompassing law in nature, which science expresses by the term "unity in variety." This interpretation of the prostate, which I believe to be true to nature, will last perhaps till such time as the microscopists shall discover in its "*secretion*" some species of mannikins, such as may pair with those which they term spermatozoa.

into a pouch caused by the points of misdirected instruments in catheterism having been rashly forced against it.

Fig. 2. — The prostate, 1 2, is here seen to be somewhat more enlarged than is natural. A tubercle, 2, surmounts the lower part, 3, of the prostate, and blocks up the vesical orifice. Catheters introduced by the urethra for retention of urine which existed in this case, have had their points arrested at the bulb, and, on being pushed forwards in this direction, have dilated the bulb into the form of a pouch, seen at 4. The sinus of the bulb, being the lowest part of the urethral canal, is very liable to be distorted or perforated by the points of instruments descending upon it from above and before.*

Fig. 3. — A cyst, 3, is seen to grow from the left side of the base of the prostate, 1 2, and to form an obstruction at the vesical orifice.

Fig. 4. — A globular excrescence, 1, appears blocking up the vesical orifice, and giving to this the appearance of a crescentic slit, corresponding to the shape of the obstructing body. The prostate, 2 2, is enlarged in both its lateral lobes. A small bougie, 3, is placed in the prostatic canal and vesical opening.

Fig. 5. — The prostate, 4, is considerably enlarged, and the vesical orifice is girt by a prominent ring, 5 8, from the right border of which the nipple-shaped body, 1, projects and occupies the outlet. Owing to the retention of urine caused by this state of the prostate, the ureters, 3 3, have become very much dilated.

Fig. 6. — The lateral lobes of the prostate, 3 3, are seen enlarged, and from the inner side and base of each, irregularly shaped masses, 1 2 3, project, and bend the prostatic urethra first to the right side, then to the left. The part, 1, resting upon the part, 2, acts like a valve against the vesical outlet, which would become closed the tighter according to the degree of superincumbent pressure. A flexible catheter would, in such a case as this, be more likely, perhaps, to follow the sinuous course of the prostatic passage than a rigid instrument of metal.

Fig. 7. — A globular mass, 1, of large size, occupies the neck of the bladder, and gives the vesical orifice, 3, a crescentic shape, convex towards the right side. The two lobes of the prostate, 2, are much enlarged.

Fig. 8. — The lateral lobes, 2 2, of the prostate are irregularly enlarged, and the urinary passage is bent towards the right side, *c*, from the membranous portion, which is central. Surmounting the vesical orifice, *c*, is seen the tuberculated mass, *a*, which being moveable, can be forced against the vesical orifice and thus produce complete retention of urine. In this case, also, a flexible catheter would be more suitable than a metallic one.

Fig. 9. — The lateral lobes, 2 2, of the prostate are enlarged. The third lobe, 1, projects at the neck of the bladder, distorting the vesical outlet. A small calculus occupies the prostatic urethra, and, being closely impacted in this part of the canal, would arrest the progress of a catheter, and probably lead to the supposition that the instrument grated against a stone in the interior of the bladder, in which case it would be inferred that since the urine did not flow through the catheter no retention existed.

Fig. 10. — Both lateral lobes, 2 3, of the prostate appear much increased in size. A large irregular shaped mass, 1, grows from the base of the right lobe, and distorts the prostatic canal and vesical orifice. When the lobes of the prostate increase in size in this direction, the prostatic canal becomes much more elongated than natural, and hence the instrument which is to be passed for relieving the existing retention of urine should have a wide and long curve to correspond with the form of this part of the urethra.*

Fig. 11. — Both lobes of the prostate are enlarged, and from the base of each a mass projects prominently around the vesical orifice, 1 2. The prostatic urethra has been moulded to the shape of the instrument, which was retained in it for a considerable time.

Fig. 12. — The prostate, 3 2, is enlarged and dilated, like a sac. Across the neck, 1, of the bladder the prostate projects in an arched form, and is transfixed by the instru-

* When a stricture exists immediately behind the bulb, this circumstance will, of course, favor the occurrence of the accident. "False passages (observes Mr. Benjamin Phillips) are less frequent here (in the membranous part of the urethra) than in the bulbous portion of the canal. The reason of this must be immediately evident: false passages are ordinarily made in consequence of the difficulty experienced in the endeavor to pass an instrument through the strictured portion of the tube. Stricture is most frequently seated at the point of junction between the bulbous and membranous portions of the canal; consequently, the false passage will be usually anterior to this latter point." — (On the Urethra, its Diseases, etc., p. 15.)

* Both lobes of the prostate are equally liable to chronic enlargement. Home believed the left lobe to be oftener increased in size than the right. Wilson (on the Male Urinary and Genital Organs) mentions several instances of the enlargement of the right lobe. No reason can be assigned why one lobe should be more prone to hypertrophy than the other, even supposing it to be matter of fact, which it is not. But the observations made by Cruveilhier (Anat. Pathol.), that the lobulated projections of the prostate always take place internally at its vesical aspect, is as true as the manner in which he accounts for the fact is plausible. The dense fibrous envelope of the prostate is sufficient to repress its irregular growth externally.

ment, 4. The prostate may assume this appearance, as well from instruments having been forced against it, as from an abscess cavity formed in its substance having received, from time to time, a certain amount of the urine, and retained this fluid under the pressure of strong efforts made to void the bladder while the vesical orifice was closed above.

Fig. 13. — The lateral lobes, 4 5, of the prostate are enlarged; and, occupying the position of the third lobe, appear as three masses, 1 2 3, plicated upon each other, and directed towards the vesical orifice, which they close like valves. The prostatic urethra branches upwards into three canals, formed by the relative position of the parts, 5 3 2 1 4, at the neck of the bladder. The ureters are dilated, in consequence of the regurgitation of the contents of the bladder during the retention which existed.

Fig. 14 exhibits the lobes of the prostate greatly increased in size. The part, 1 2, girds irregularly, and obstructs the vesical outlet, while the lateral lobes, 3 4, encroach upon the space of the prostatic canal. The walls of the bladder are much thickened.

Fig. 15. — The three lobes, 1 2 3, of the prostate are enlarged and of equal size, moulded against each other in such a way that the prostatic canal and vesical orifice appear as mere clefts between them. The three lobes are incrusted on their vesical surfaces with a thick calcareous deposit. The surface of the third lobe, 1, which has been half denuded of the calcareous crust, 2, in order to show its real character, appeared at first to be a stone impacted in the neck of the bladder, and of such a nature it certainly would seem to the touch, on striking it with the point of a sound or other instrument.

Fig. 16 represents the prostate with its three lobes enlarged, and the prostatic canal and vesical orifice narrowed. The walls of the bladder are thickened, fasciculated, and sacculated; the two former appearances being caused by a hypertrophy of the vesical fibres, while the latter is in general owing to a protrusion of the mucous membrane between the fasciculi.

Fig. 17. — The prostate presents four lobes, 1 2 3 4, each being of large size, and projecting far into the interior of the bladder, from around the vesical orifice which they obstruct. The bladder is thickened, and the prostatic canal is elongated. The urethra and the lobes of the prostate have been perforated by instruments, passed for the retention of urine which existed. A stricturing band, 5, is seen to cross the membranous part of the canal.

Fig. 18. — The prostate, 1 1, is greatly enlarged, and projects high in the bladder, the walls of the latter, 2 2, being very much thickened. The ureters, 3, are dilated, and perforations made by instruments are seen in the prostate. The prostatic canal being directed almost vertically, and the neck of the bladder being raised nearly as high as the upper border of the pubic symphysis, it must appear that if a stone rest in the bas fond of the bladder, a sound or staff cannot reach the stone, unless by perforating the prostate; and if, while the staff occupies this position, lithotomy be performed, the incisions will not be required to be made of a greater depth than if the prostate were of its ordinary proportions. On the contrary, if the staff happen to have surmounted the prostate, the incision, in order to divide the whole vertical thickness of this body, will require to be made very deeply from the perinæal surface, and this circumstance occasions what is termed a "deep perinæum."

Fig. 19. — The lower half, 3 2 6, of the prostate, having become the seat of abscess, appears hollowed out in the form of a sac. This sac is separated from the bladder by a horizontal septum, 5 5, the proper base of the bladder, 7 7. The prostatic urethra, between 1 5, has become vertical in respect to the membranous part of the canal, in consequence of the upward pressure of the abscess. The sac opens into the urethra, near the apex of the prostate, at the point, 3; and a catheter passed along the urethra has entered the orifice of the sac, the interior of which the instrument traverses, and the posterior wall of which it perforates. The bladder contains a large calculus, 1*. The bladder and sac do not communicate, but the urethra is a canal common to both. In a case of this sort it becomes evident that, although symptoms may strongly indicate either a retention of urine, or the presence of a stone in the bladder, any instrument taking the position and direction of 4 4, cannot relieve the one or detect the other; and such is the direction in which the instrument must of necessity pass, while the sac presents its orifice more in a line with the membranous part of the urethra than the neck of the bladder is. The sac will intervene between the rectum and the bladder; and on examination of the parts through the bowel, an instrument in the sac will readily be mistaken for being in the bladder, while neither a calculus in the bladder, nor this organ in a state of even extreme distention, can be detected by the touch any more than by the sound or catheter. If, while performing lithotomy in such a state of the parts, the staff occupy the situation of 4 4 4, then the knife, following the staff, will open, not the bladder which contains the stone, but the sac, which, moreover, if it happen to be filled with urine regurgitated from the urethra, will render the deception more complete.

Fig. 20. — The walls, 1 1, of the bladder, appear greatly thickened, and the ureters, 2, dilated. The sides, 3 3 3, of the prostate are thinned; and in the prostatic canal are two calculi, 4 4, closely impacted. In such a state of the parts it would be impossible to pass a catheter into the bladder for the relief of a retention of urine, or to introduce a staff as a guide to the knife in lithotomy. If, however, the staff can be passed as far as the situation of the stone, the parts may be held with a sufficient degree of steadiness to enable the operator to incise the prostate upon the stone.

PLATE 32.

DEFORMITIES OF THE URINARY BLADDER.—THE OPERATIONS OF SOUNDING FOR STONE, OF CATHETERISM, AND OF PUNCTURING THE BLADDER ABOVE THE PUBES.

The urinary bladder presents two kinds of deformity, —viz., congenital and pathological. As examples of the former may be mentioned that in which the organ is deficient in front, and has become everted and protruded like a fungous mass through an opening at the median line of the hypogastrium; that in which the rectum terminates in the bladder posteriorly; and that in which the fœtal urachus remains pervious as a uniform canal, or assumes a sacculated shape between the summit of the bladder and the umbilicus. The pathological deformities are, those in which vesical fistulæ, opening either above the pubes, at the perinæum, or into the rectum, have followed abscesses or the operation of puncturing the bladder in these situations, and those in which the walls of the organ appear thickened and contracted, or thinned and expanded, or sacculated externally, or ridged internally, in consequence of its having been subjected to abdominal pressure while over-distended with its contents, and while incapable of voiding these, from some permanent obstruction in the urethral canal.* The bladder is liable to become sacculated from two causes,—from a hernial protrusion of its mucous membrane through the separated fasciculi of its fibrous coat, or from the cyst of an abscess which has formed a communication with the bladder, and received the contents of this organ. Sacs, when produced in the former way, may be of any number, or size, or in any situation; when caused by an abscess, the sac is single, is generally formed in the prostate, or corresponds to the base of the bladder, and may attain to a size equalling, or even exceeding, that of the bladder itself. The sac, however formed, will be found lined by mucous membrane. The cyst of an abscess, when become a recipient for the urine, assumes after a time a lining membrane similar to that of the bladder. If the sac be situated at the summit or back of the bladder, it will be found invested by peritonæum; but, whatever be its size, structure, or position, it may be always distinguished from the bladder by being devoid of the fibrous tunic, and by having but an indirect relation to the vesical orifice.

Fig. 1.—The lateral lobes of the prostate, 3 4, are enlarged, and contract the prostatic canal. Behind them the third lobe of smaller size occupies the vesical orifice, and completes the obstruction. The walls of the bladder have hence become fasciculated and sacculated. One sac, 1, projects from the summit of the bladder; another, 2, containing a stone, projects laterally. When a stone oc-

* On considering these cases of physical impediments to the passage of urine from the vesical reservoir through the urethral conduit, it seems to me as if these were sufficient to account for the formation of stone in the bladder, or any other part of the urinary apparatus, without the necessity of ascribing it to a constitutional disease, such as that named the *lithic diathesis* by the humoral pathologists.

The urinary apparatus (consisting of the kidneys, ureters, bladder, and urethra) is known to be the principal emunctory for eliminating and voiding the detritus formed by the continual decay of the parts comprising the animal economy. The urine is this detritus in a state of solution. The components of urine are chemically similar to those of calculi, and, as the components of the one vary according to the disintegration occurring at the time in the vital alembic, so do those of the other. While, therefore, a calculus is only as urine precipitated and solidified, and this fluid only as calculous matter suspended in a menstruum, it must appear that the lithic diathesis is as natural and universal as structural disintegration is constant and general in operation. As every individual, therefore, may be said to void day by day a dissolved calculus, it must follow that its form of precipitation within some part of the urinary apparatus alone constitutes the disease, since in this form it cannot be passed. On viewing the subject in this light, the question that springs directly is, (while the lithic diathesis is common to individuals of all ages and both sexes,) why the lithic sediment should present in the form of concrement in some and not in others? The principal, if not the sole, cause of this seems to me to be obstruction to the free egress of the urine along the natural passage. Aged individuals of the male sex, in whom the prostate is prone to enlargement, and the urethra to organic stricture, are hence more subject to the formation of stone in the bladder than youths, in whom these causes of obstruction are less frequent, or than females of any age, in whom the prostate is absent, and the urethra simple, short, readily dilatable, and seldom or never strictured. When an obstruction exists, lithic concretions take place in the urinary apparatus in the same manner as sedimentary particles cohere or crystallize elsewhere. The urine becoming pent up and stagnant while charged with saline matter, either deposits this around a nucleus introduced into it, or as a surplus when the menstruum is insufficient to suspend it. The most depending part of the bladder is that where lithic concretions take place; and if a sacculus exist here, this, becoming a recipient for the matter, will favor the formation of stone.

cupies a sac, it does not give rise to the usual symptoms as indicating its presence, nor can it be always detected by the sound.

Fig. 2. — The prostate, 2 3, is enlarged, and the middle lobe, 2, appears bending the prostatic canal to an almost vertical position, and obstructing the vesical orifice. The bladder, 1 1 1, is thickened; the ureters, 7, are dilated; and a large sac, 6 6, projects from the base of the bladder backwards, and occupies the recto-vesical fossa. The sac, equal in size to the bladder, communicates with this organ by a small circular opening, 8, situated between the orifices of the ureters. The peritonæum is reflected from the summit of the bladder to that of the sac. A catheter, 4, appears perforating the third lobe of the prostate, 2, and entering the sac, 5, through the base of the bladder, below the opening, 8. In a case of this kind, a catheter occupying the position, 4 5, would, while voiding the bladder through the sac, make it seem as if it really traversed the vesical orifice. If a stone occupied the bladder, the point of the instrument in the sac could not detect it, whereas, if a stone lay within the sac, the instrument, on striking it here, would give the impression as if it lay within the bladder.

Fig. 3. — The urethra being strictured, the bladder has become sacculated. In the bas fond of the bladder appears a circular opening, 2, leading to a sac of large dimensions, which rested against the rectum. In such a case as this, the sac, occupying a lower position than the base of the bladder, must first become the recipient of the urine, and retain this fluid even after the bladder has been evacuated, either voluntarily or by means of instruments. If, in such a state of the parts, retention of urine called for puncturation, it is evident that this operation would be performed with greater effect by opening the depending sac through the bowel, than by entering the summit of the bladder above the pubes.

Fig. 4. — The vesical orifice is obstructed by two portions, 3 4, of the prostate, projecting upwards, one from each of its lateral lobes, 6 6. The bladder is thickened and fasciculated, and from its summit projects a double sac, 1 2, which is invested by the peritonæum.

Fig. 5. — The prostatic canal is constricted and bent upwards by the third lobe. The bladder is thickened, and its base is dilated in the form of a sac, which is dependent, and upon which rests a calculus. An instrument enters the bladder by perforating the third lobe, but does not come into contact with the calculus, owing to the low position occupied by this body.

Fig. 6. — Two sacs appear projecting on either side of the base of the bladder. The right one, 5, contains a calculus, 6; the left one, of larger dimensions, is empty. The rectum lay in contact with the base of the bladder between the two sacs.

Fig. 7. — Four calculi are contained in the bladder. This organ is divided by two septa, 2 4, into three compartments, each of which, 1 3 5, gives lodgment to a calculus; and another, 6, of these bodies lies impacted in the prostatic canal, and becomes a complete bar to the passage of a catheter. Supposing lithotomy to be performed in an instance of this kind, it is probable that, after the extraction of the calculi, 6 5, the two upper ones, 3 1, would, owing to their being imbedded in the walls of the bladder, escape the forceps.

Fig. 8. — Two large polypi, and many smaller ones, appear growing from the mucous membrane of the prostatic urethra and vesical orifice, and obstructing these parts. In examining this case during life by the sound, the two larger growths, 1 2, were mistaken by the surgeon for calculi. Such a mistake might well be excused if they happened to be incrusted with lithic matter.

Fig. 9. — The base of the bladder, 8 8, appears dilated into a large uniform sac, and separated from the upper part of the organ by a circular horizontal fold, 2 2. The ureters are also dilated. The left ureter, 3 4, opens into the sac below this fold, while the right ureter opens above it into the bladder. In all cases of retention of urine from permanent obstruction of the urethra, the ureters are generally found more or less dilated. Two circumstances combine to this effect, — while the renal secretion continues to pass into the ureters from above, the contents of the bladder under abdominal pressure are forced regurgitating into them from below, through their orifices.

Fig. 10. — The bladder, 6, appears symmetrically sacculated. One sac, 1, is formed at its summit, others, 3 2, project laterally, and two more, 5 4, from its base. The ureters, 7 7, are dilated, and enter the bladder between the lateral and inferior sacs.

Fig. 11. — The prostate is greatly enlarged, and forms a narrow ring around the vesical orifice. Through this an instrument, 12, enters the bladder. The walls of the bladder are thickened and sacculated. On its left side appear numerous sacs, 2 3 4 5 6 7 8, and on the inner surface of its right side appear the orifices of as many more. On its summit another sac is formed. The ureters, 9, are dilated.

Fig. 12. — The prostate is enlarged, its canal is narrowed, and the bladder is thickened and contracted. A calculus, 1 2, appears occupying nearly the whole vesi-

cal interior. The incision in the neck of the bladder in lithotomy must necessarily be extensive, to admit of the extraction of a stone of this size.

Fig. 13. — The prostatic canal is contracted by the lateral lobes, 4 5; resting upon these, appear three calculi, 1 2 3, which nearly fill the bladder. This organ is thickened and fasciculated. In cases of this kind, and that last mentioned, the presence of stone is readily ascertainable by the sound.

Fig. 14. — The three prostatic lobes are enlarged, and appear contracting the vesical orifice. In the walls of the bladder are imbedded several small calculi, 2 2 2 2, which, on being struck with the convex side of a sound, might give the impression as though a single stone of large size existed. In performing lithotomy, these calculi would not be within reach of the forceps.

Fig. 15. — Two sacculi, 4 5, appear projecting at the middle line of the base of the bladder, between the vasa deferentia, 7 7, and behind the prostate, in the situation where the operation of puncturing the bladder per anum is recommended to be performed in retention of urine.

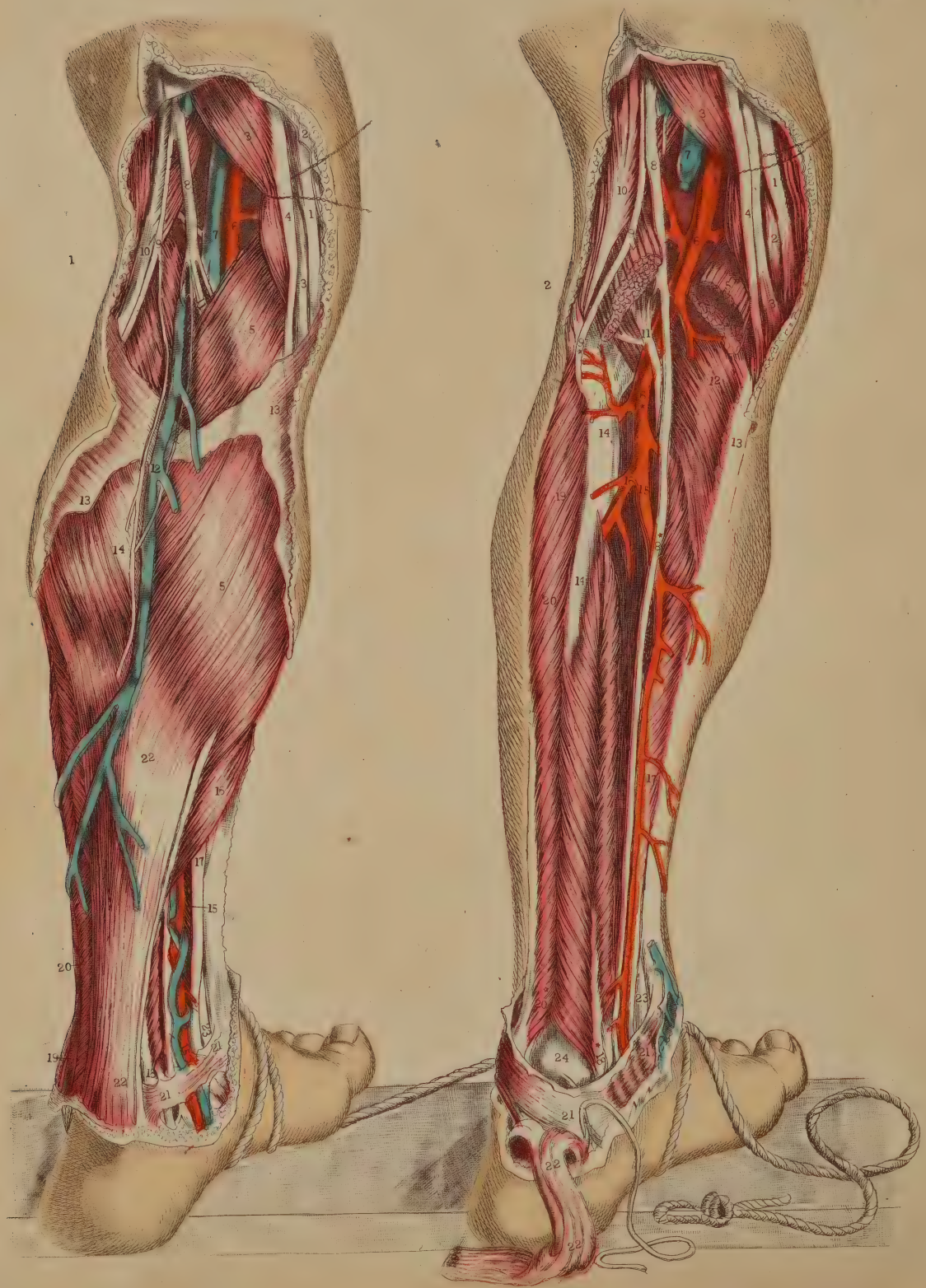
Fig. 16. — A sac, 4, is situated on the left side of the bladder, 3 3, immediately above the orifice of the ureter. In the sac was contained a mass of phosphatic calculus. This substance is said to be secreted by the mucous lining of the bladder, while in a state of chronic inflammation, but there seems nevertheless very good reason for us to believe that it is, like all other calculous matter, a deposit from the urine.

Fig. 17 represents, in section, the relative position of the parts concerned in catheterism.* In performing this operation, the patient is to be laid supine; his loins are to be supported on a pillow; and his thighs are to be flexed and drawn apart from each other. By this means the perinæum is brought fully into view, and its structures are made to assume a fixed relative position. The operator, standing on the patient's left side, is now to raise the penis so as to render the urethra, 8 8 8, as straight as possible between the meatus, *a*, and the bulb, 7. The instrument (the concavity of its curve being turned to the left groin) is now to be inserted into the meatus, and while being gently impelled through the canal, the urethra is to be drawn forwards, by the left hand, over the instrument. By stretching the urethra, we render its sides sufficiently tense for facilitating the passage of the instrument, and the orifices of the lacunæ become closed. While the instrument is being passed along this part of the canal, its point should be directed fairly towards the urethral opening, 6*, of the triangular ligament, which is situated an inch or so below the pubic symphysis, 11. With this object in view, we should avoid depressing its handle as yet, lest its point be prematurely tilted up, and rupture the upper side of the urethra anterior to the ligament. As soon as the instrument has arrived at the bulb, its further progress is liable to be arrested, from these causes: — 1st, This portion of the canal is the lowest part of its perinæal curve, 3 6 8, and is closely embraced by the middle fibres of the accelerator urinæ muscle. 2d, It is immediately succeeded by the commencement of the membranous urethra, which, while being naturally narrower than other parts, is also the more usual seat of organic stricture, and is subject to spasmodic constriction by the fibres of the compressor urethræ. 3d, The triangular ligament is behind it, and, if the urethral opening of the ligament be not directly entered by the instrument, this will bend the urethra against the front of that dense structure. On ascertaining these to be the causes of resistance, the instrument is to be withdrawn a little in the canal, so as to admit of its being reädjusted for engaging precisely the opening in the triangular ligament. As this structure, 6, is attached to the membranous urethra, 6**, which perforates it, both these parts may be rendered tense, by drawing the penis forwards, and thereby the instrument may be guided towards and through the aperture. The instrument having passed the ligament, regard is now to be paid to the direction of the pelvic portion of the canal, which is upwards and backwards to the vesical orifice, 3, 3*, 3. In order that the point of the instrument may freely traverse the urethra in this direction, its handle, 1*, requires to be depressed, 2*, 3*, slowly towards the perinæum, and at the same time to be impelled steadily back in the line, 4*, 4*, through the pubic arch, 11. If the third lobe of the prostate happen to be enlarged, the vesical orifice will accordingly be more elevated than usual. In this case, it becomes necessary to depress the instrument to a greater extent than is otherwise required, so that its point may surmount the obstacle. But since the suspensory ligament of the penis, 10, and the perinæal structures, prevent the handle being depressed beyond a certain degree, which is insufficient for the object to be attained, the instrument should possess the *prostatic curve*, 3*, compared with 3*, 2*.

In the event of its being impossible to pass a catheter by the urethra, in cases of retention of urine threatening

* It may be necessary for me to state that, with the exception of this figure (which is obviously a plan, but sufficiently accurate for the purposes it is intended to serve) all the others representing pathological conditions and congenital deformities of the urethra, the prostate, and the bladder, have been made by myself from *natural specimens* in the museums and hospitals of London and Paris.

rupture, the base or the summit of the bladder; according as either part may be reached with the greater safety to the peritonæal sac, will require to be punctured. If the prostate be greatly and irregularly enlarged, it will be safer to puncture the bladder above the pubes, and here the position of the organ in regard to the peritonæum, 1, becomes the chief consideration. The shape of the bladder varies very considerably from its state of collapse, 3 3 5 to, those of mediate, 3 3 2 1, and extreme distention, 3 3 4. This change of form is chiefly effected by the expansive elevation of its upper half, which is invested by the peritonæum. As the summit of the bladder falls below, and rises above the level of the upper margin of the pubic symphysis, it carries the peritonæum with it in either direction. While the bladder is fully expanded, 4, there occurs an interval between the margin of the symphysis pubis and the point of reflection of the peritonæum, from the recti muscles, to the summit of the viscus. At this interval, close to the pubes, and in the median line, the trocar may be safely passed through the front wall of the bladder. The instrument should, in all cases, be directed downwards and backwards, 8*, 8*, in a line pointing to the hollow of the sacrum.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DESCRIPTION OF PLATE 33.

Figure 1.

1. Tendon of the gracilis muscle.
2. The fascia lata.
3. Tendon of the semimembranosus muscle.
4. Tendon of the semitendinosus muscle.
5. The two heads of the gastrocnemius muscle.
6. The popliteal artery.
7. The popliteal vein joined by the short saphena vein.
9. The middle branch of the sciatic nerve.
8. The outer (peronæal) branch of the sciatic nerve.
10. The posterior tibial nerve continued from the middle branch of the sciatic, and extending to 10, behind the inner ankle.
11. The posterior (short) saphena vein.
12. The fascia covering the gastrocnemius muscle.
13. The short (posterior) saphena nerve, formed by the union of branches from the peronæal and posterior tibial nerves.
14. The posterior tibial artery appearing from beneath the soleus muscle in the lower part of the leg.
15. The soleus muscle joining the tendo Achillis.
16. The tendon of the flexor longus communis digitorum muscle.
17. The tendon of the flexus longus pollicis muscle.
18. The tendon of the peronæus longus muscle.
19. The peronæus brevis muscle.
20. The internal annular ligament binding down the vessels, nerves, and tendons in the hollow behind the inner ankle.
21. The tendo Achillis.
22. The tendon of the tibialis posticus muscle.
23. The venæ comites of the posterior tibial artery.

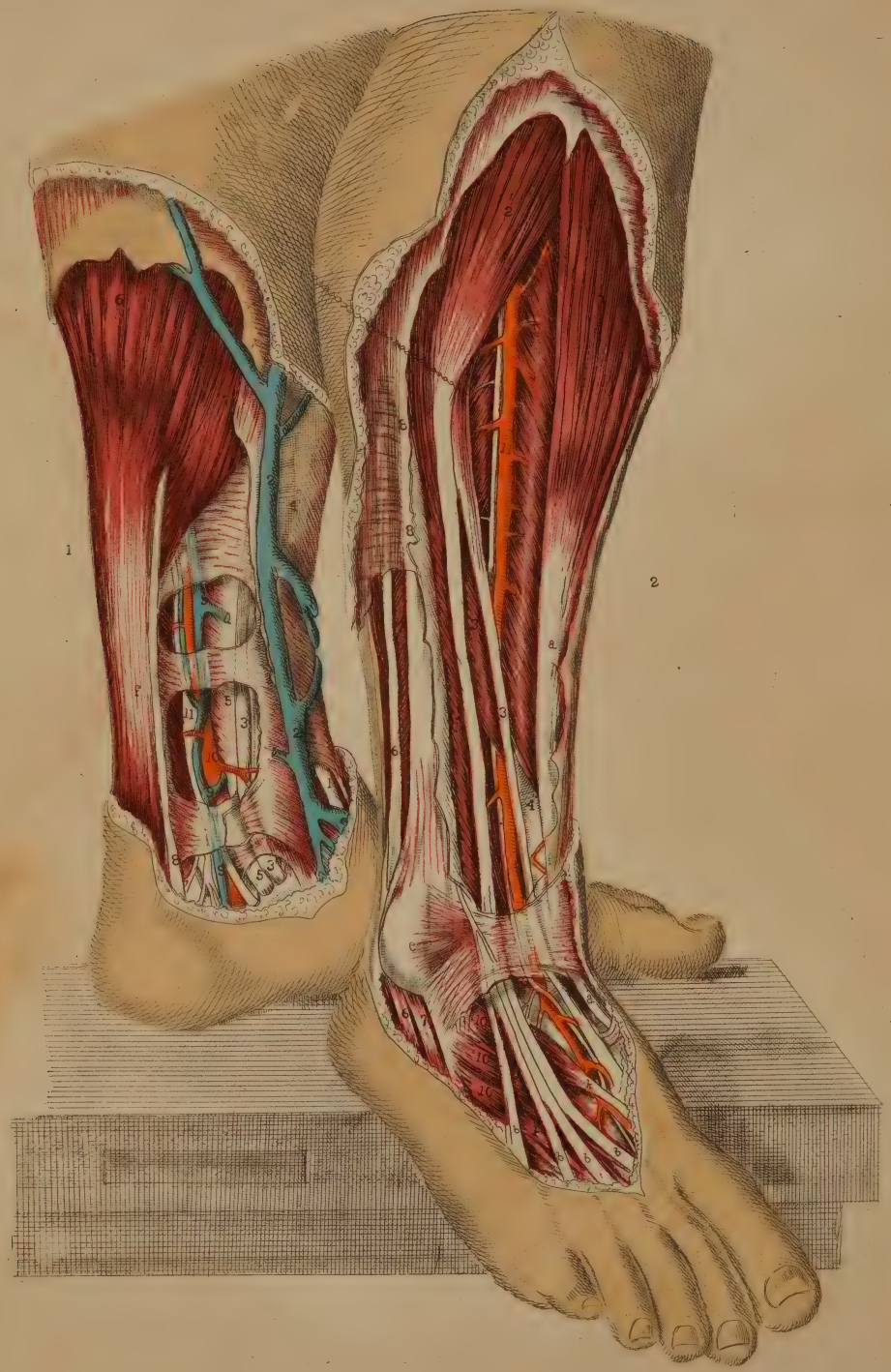
Figure 2.

1, 3, 4, 5, 6, 7, 8, 9, indicate the same parts as in Fig. 1.

2. The inner condyle of the femur.
10. The plantaris muscle lying upon the popliteal artery.
11. The popliteus muscle.
13. The tibia.
14. The fibula.
15. The posterior tibial artery.
16. The peronæal artery.

17, 18, 19, 20, 21, 22, 23. The parts shown in Fig. 1.

24. The astragalus.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DESCRIPTION OF PLATE 34.

Figure 1.

1. The tendon of the tibialis anticus muscle.
2. The long saphena vein.
3. The tendon of the tibialis posticus muscle.
4. The tibia; *d*, the inner malleolus.
5. The tendon of the flexor longus digitorum muscle.
6. The gastrocnemius muscle; *f*, the tendo Achillis.
7. The soleus muscle.
8. The tendon of the plantaris muscle.
9. The venæ comites.
10. The posterior tibial artery.
11. The posterior tibial nerve.

Figure 2.

1. The tibialis anticus muscle; *a*, its tendon.
2. The extensor longus digitorum muscle; *b b b b*, its four tendons.
3. The extensor longus pollicis muscle.
4. The tibia.
5. The fibula; *e*, the outer malleolus.
6. The tendon of the peronæus longus muscle.
7. The peronæus brevis muscle; *i*, the peronæus tertius.
8. The fascia.
10. The extensor brevis digitorum muscle; *k k*, its tendons.
11. The anterior tibial artery and nerve descending to the dorsum of the foot.

DESCRIPTION OF PLATE 35.

Figure 1.

1. The calcaneum.
2. The plantar fascia and flexor brevis digitorum muscle cut; *b b b*, its tendons.
3. The abductor minimi digiti muscle.
4. The abductor pollicis muscle.
5. The flexor accessorius muscle.
6. The tendon of the flexor longus digitorum muscle, subdividing into *f f f f*, tendons for the four outer toes.
7. The tendon of the flexor pollicis longus muscle.
8. The flexor pollicis brevis muscle.

i i i i. The four lumbricales muscles.

10. The external plantar nerve.
11. The external plantar artery.
12. The internal plantar nerve and artery.

Figure 2.

1. The heel covered by the integument.
2. The plantar fascia and flexor brevis digitorum muscle cut; *b b b*, the tendons of the muscle.
3. The abductor minimi digiti.
4. The abductor pollicis.
5. The flexor accessorius cut.
6. The tendon of the flexor digitorum longus cut; *f f f*, its digital ends.
7. The tendon of the flexor pollicis.
8. The head of the first metatarsal bone.
9. The tendon of the tibialis posticus.
10. The external plantar nerve.
11. The arch of the external plantar artery.
12. The four interosseous muscles.
13. The external plantar nerve and artery cut.

DESCRIPTION OF PLATE 36.

FROM BOURGERY.

THE NECK.

1st. Suprahyoid Region.

A. Parotid gland.

B. Submaxillary gland. 1. Submental artery and vein, accompanied by lymphatic ganglions passing over the surface of the mylo-hyoid muscle.

C. Place of the maxillary belly of the digastric muscle, which has been removed; the sheath is seen behind and at the sides.

2d. Subhyoid Region.

D. Place of the sterno-hyoid, at the bottom of which are seen the sterno-thyroid and thyro-hyoid muscles.

E. Scapulo-hyoid, uncovered. Beyond, in its continuation, it is seen through the transparent sheath of the sterno-mastoid muscle.

From F to F is seen the place of the sterno-mastoid muscle, the body of which has been dissected out, leaving the posterior part of its sheath; a part of the upper portion of the muscle is preserved. The external jugular vein (2) is seen crossing this space diagonally.

In the space occupied by the muscle, the vessels and nerves belonging to it are shown, and behind its transparent sheath are seen, 3. The primitive carotid artery; 4. The internal jugular vein; also the origin of the thyroid vessels, and numerous lymphatic vessels and nerves.

THE ARMPIT. The arm being elevated.

The figure shows the armpit, properly so called, and the parts adjacent. 1. The axillary cavity, situated between the great pectoral muscle before, the teres major and the great dorsal behind; 2. The region of the axillary vessels seen behind the sheaths of the pectoral muscles; 3. Internal and superior brachial region.

1st. Hollow of the Armpit.

F. 5. Mass of lymphatic ganglions, imbedded in adipose tissue. It is isolated by a layer of the sheath of the great pectoral from the region of the axillary vessels. The hollow of the armpit is traversed by the inferior scapular vessels, 6, the thoracic vessels, 7, and by the inferior branches of the plexus of nerves which accompany them.

G. Superior extremity of the great dorsal muscle, with its vessels and nerves, a portion of which, as may be seen, has been dissected out.

H. A portion of the sheath of the great dorsal muscle, which limits the axillary cavity behind.

I. Space occupied by the great pectoral muscle, the sheath of which limits the axillary cavity before and on the inside. Superiorly, as may be seen, it passes before the great vessels and nerves. In going backward, it unites with their sheaths, and receives from without the brachial aponeurosis, and forms the only true line of demarcation between the subclavicular region and superior internal brachial region.

K. Fold of the brachial aponeurosis, which is seen to join the tendons of the great dorsal and great pectoral muscles, adhering to the roots of the great vessels, and limiting the depth of the axilla above.

2d. Subclavicular Region.

The place of the great pectoral muscle is shown, and also that of the little pectoral muscle, portions of both being dissected away to show the vessels. The deltoid muscle is cut off near its scapular attachment.

8. Axillary artery. 9. Axillary vein, a little drawn downward, to uncover the nerves. 10. Trunk of the external cutaneous nerve, before which may be seen a branch of the median. 11. One of the roots of the median nerve. 12, 12. Acromio-thoracic vessels with the nerves, which are distributed to the pectoral muscles. 13. Cephalic vein.

L. Subclavian muscle inclosed in its sheath.

3d. Internal Superior Brachial Region.

M. Portion of the place of the biceps muscle, the two extremities of which are left. In this space are seen the vessels and nerves belonging to it, and beneath, through the transparent sheath, the deltoid muscle.

N. Surface of the triceps, covered by the posterior brachial aponeurosis, which is inserted upon the tendons of the great dorsal and the teres major.

This surface is traversed by the internal cutaneous brachial branches of the second and third pairs of intercostal nerves.

14. Brachial artery. 15. Internal humeral vein. 16. Basilic vein. 17. Musculo-cutaneous nerve. 18. Median nerve. 19. Internal cutaneous nerve. 20. Ulnar nerve.

The radial nerve and the external collateral vessels are not seen in this arrangement of the figure.

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SURGICAL ANATOMY